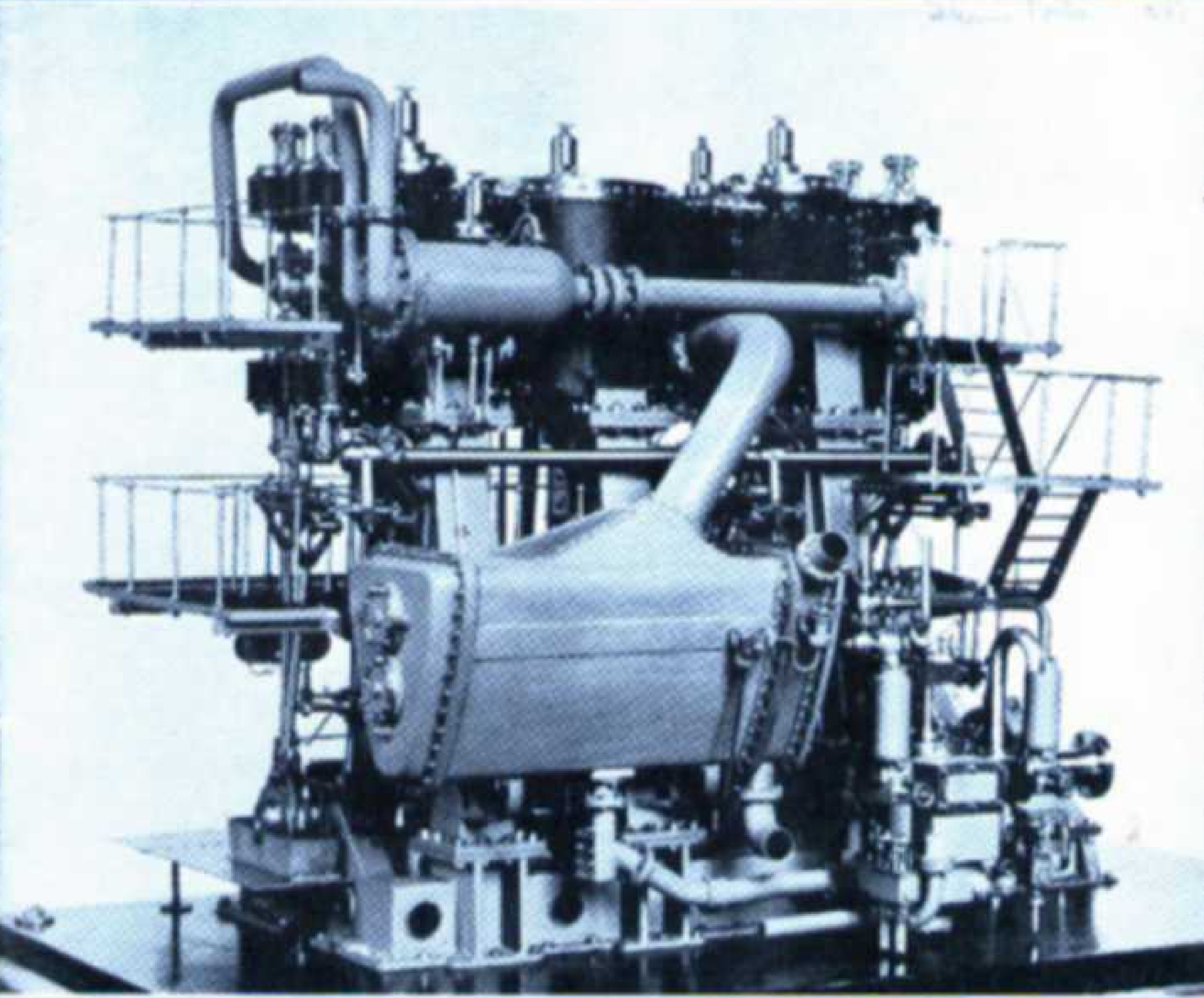
# THE MODEL ENGINEER



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JULY 16th, 1953
Vol 109 No. 2721

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# THE MODEL ENGINEER

EVERY THURSDAY

Volume 109 - No. 2721

JULY 16th, - 1953

ESTABLISHED 1898

PERCIVAL MARSHALL & CO. LTD. 19-20 NOEL STREET · LONDON · W·1


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### Our Cover Picture

The marine steam engine, in any of its many forms, offers unlimited scope as a subject for modelling, and models of engines of this type have won premier awards at many exhibitions. One of the best-known exponents of marine engine models is Mr. W. T. Barker, of the S.M.E.E., whose collection of historic models, described in the issue of *THE MODEL ENGINEER* dated March 27th, 1952, is acknowledged to be one of the finest in existence, and forms a series which illustrates the evolution of the marine engine from the days of the side lever paddle engine onwards. The latest model he has constructed is the one shown in this photograph, which represents the latest development of the triple-expansion reciprocating engine, as exemplified in an engine built by the North Eastern Marine Engineering Co. Ltd., and first installed in a sea-going ship in 1937. It is of the reheater type, with balanced poppet valves for inlet and exhaust on h.p. and m.p. cylinders and a balanced flat slide valve for the l.p. cylinder. A close examination of the photograph will show the enormous amount of fine detail work in all the working parts of the model, and it is of interest to note that it has been produced with modest tool equipment.

# SMOKE RINGS

### The Savery Engine

THE PUBLICATION of the description of Mr. A. W. G. Tucker's Savery launch engine, in THE MODEL ENGINEER for January 8th, brought in a large number of letters, all of which expressed pleasure and praised Mr. Tucker's work. A letter from a Canadian reader, however, adds some points of interest; it reads: "This is a perfect job, as the second marine engine I ever ran was one of these in a small tugboat. I was only 19 years old at the time, and I can assure you I was very proud of my engine. The boat was 45 ft. long by 9 ft. beam, with a coal-fired watertube boiler. The engine turned 475 revs.

"When I say the engine was silent, I mean just that. The only sound at full speed was the clicking of the boiler check at three times less engine speed. The balance was perfect; on deck there was no feeling to indicate the boat was engine driven at all.

"A point not mentioned by Mr. Tucker is that the valves were made with the top bobbin larger than the lower one, giving a differential area equal to the area of the valve stem, thus balancing the thrust of the valve steam area. My engine was 17 years old when I ran it, and the all-glass-hard valve gear was ground to 0.0001 in. clearance when new. I am sure that it had never worn one little bit."

These old steam engines somehow had the power of inspiring feelings of confidence, pride, pleasure and affection, a power that, somehow, is lacking in other power plant!

### How Old Is It?

IT HAS recently been reported that some cart tracks excavated at Mohenjo-Daro, and estimated to date from about 2500 B.C., were found to be of the same width as the standard railway gauge, that is 4 ft. 8½ in. If this information is correct, it raises a number of interesting questions. What actually decided that this was a suitable gauge, or track width, for wheeled vehicles? Who first made the decision? Why, in spite of some attempts to break away from it, made by railway pioneers in certain parts of the world, has it remained the almost universal standard for something like 5,000 years? For the Mohenjo-Daro discovery has brought to light what we believe is the earliest example of the 4 ft. 8 in. gauge.

We know that the present standard railway gauge was derived from the old colliery tramway gauge, which, in turn, was the same as that of the ancient Roman and Assyrian chariots. But, presumably, this is no precise criterion of its antiquity; it appears to be much older than that. The problem is made all the more interesting by reason of the fact that the modern systems of English and Metric measures had not been invented all those thousands of years ago. Granted that 4 ft. 8 in. is purely an arbitrary dimension, due to the fact that it is what the track gauge actually measures in English units—it is about 1,440 mm. in metric units—that is no indication of its age, nor does it appear to offer any clue to what caused it to be adopted originally, or to who "invented" it.

### The First Horwich Locomotive

WE LEARN that the Lancashire and Yorkshire Railway Society, a body of enthusiasts formed to study and perpetuate the history of the railway after which it is named, is making strenuous efforts to ensure the preservation of British Railways engine No. 50261. There is plenty of justification for such a scheme, for this engine was built as L. & Y. No. 1008 at Horwich works in February, 1889, and was not only the first new engine to be built at that world-famous works, but was also the first of that equally celebrated class of 2-4-2 tank engines designed by the late Sir John Aspinall. A large number of these engines were built and they built up a reputation that cannot be beaten by that of any other class of tank locomotive. Their days are now numbered, for the engines are being withdrawn, worn out by hard work.

# Model Power Boat News

BY MERIDIAN

## REGATTAS AT BOURNVILLE, ST. ALBANS AND WELLING

THE annual Whitsuntide regatta of the Bournville M.Y. & P.B. Club is always an interesting event. In spite of a change of day to Whit. Saturday, this year's event attracted almost as many entries as the usual Whit. Monday regattas. The change was necessitated by local Coronation arrangements ; many firms in the Birmingham area were working on the Monday.

The programme commenced with a steering competition and this was contested by quite a number of different craft. The St. Albans and Wallasey clubs were particularly well represented—the latter with a team of four boats. Due to a strong cross wind and a fairly long course, scoring was low, but Mr. Mappelbeck (St. Albans), with a nice-looking petrol-driven launch, scored 6 points out of a possiole 9, to win the event, and Mr. P. Lambert (St. Albans) took second place with his destroyer.

The water looked to be fairly smooth for the pole boats, but appearances were deceptive, and a slight swell on the surface caused many capsizes among the smaller boats. Mr. R. Mitchell (Runcorn) was one of the sufferers, but nevertheless managed to take first place in Class "B" with *Beta IV*, and second in Class "C" with *Gamma* 2. A newcomer to regatta racing events was Mr. J. Jones (Maghull), whose boat *Mambo* made two very creditable runs in the Class "C" race.

In the Class "B" race, much interest was aroused by Mr. A. Cockman's new flash-steamer *Ifit* 9, which made a first appearance. This boat is a superb piece of work, but teething troubles were apparent, and some difficulty was experienced when getting the boat away.

Another new effort is Mr. G. Lines' *Sparky* 3, and this boat is only about half the weight of *Sparky* 2. Although one run was completed, the running appeared somewhat unstable, and thus lost much speed. The new engine, however, looks as if it is developing a lot of power.

**Results**

*Steering Competition*

(1) R. Mapplebeck (St. Albans), *SA*4, 6 pts.
(2) P. Lambert (St. Albans), *Sea Devil*, 4 pts.
(3) G. Jones (Victoria), *Fidelis*, 3 pts.

500 *yd. Class " C " Race*

(1) L. Stanworth (Bournville), *Meteor IV*, 49.1 m.p.h.
(2) R. Mitchell (Runcorn), *Gamma* 2, 41.8 m.p.h.

500 *yd. " C " Restricted Race*

(1) S. Poyser (Victoria) *Rumpus* 6, 44.5 m.p.h.
(2) K. Hyder (St. Albans), *Slipper* 4, 36.4 m.p.h.

500 *yd. Class " B " Race*

(1) R. Mitchell (Runcorn) *Beta* 4, 41.8 m.p.h.
(2) S. Poyser (Victora), *Rumpus* 4, 39.7 m.p.h.

500 *yd. Class " A " Race for the Coronation Trophy*

(1) E. Clark (Victoria), *Gordon* 2, 56.4 m.p.h.
(2) J. Benson (Blackheath), *Orthon*, 55.2 m.p.h.

*A. Newcombe (Victoria) starting " Silver Foam "*

*W. Morris (Bournville) with "Ned Kelly"*

**St. Albans and N. London Regatta**

This regatta was held recently on the lake at Verulamium, St. Albans, and was supported by a very large entry indeed. Over 60 different boats contested the various events, and a large crowd of spectators remained throughout the day, keenly interested in the various happenings. The steering and nomination events were keenly contested, and in the former most of the boats managed to score at least once. J. Chandler (Southend), with *Iope*, made the excellent score of 13 points to win, and four others—Messrs. Vanner, Burgess, Skingley and Benson, tied with 11 points each. On the run-off Ted Vanner emerged the leader, and thus took second place. J. Burgess (Cheltenham) was third.

Several more new speed craft made an appearance at this regatta, and one of these, J. Bamford's *Jab III*, won the Class "B" race at 51.14 m.p.h. This boat runs well and seems to have exceptional stability for the type of hull.

Class "A" produced two interesting debuts—W. Brightwell's new four-stroke job and yet another flash-steamer by B. Pilliner. Mr. Brightwell will be remembered as a very active member of the Wicksteed club in pre-war days, and his new boat showed signs of high speed. Unfortunately a piston failure prevented an almost certain place in the 1,000 yd. Class "A" race. Mr. Pilliner (Southampton) is one of the few flash steam exponents still surviving, but a very worthy one. The new boat shows his usual ingenuity and fine work, and is obviously very powerful, but it is suffering at the moment from the usual plague of flash-steamers, namely, cooling off after a few laps.

**Results**

80 *yd, Nomination Race*

(1) Mr. Drayson (N. London), *Nippy*, 2.2 per cent. error.
(2) R. Mapplebeck (St. Albans), *SA*4, 3.9 per cent. error.
(3) P. Cleary (Blackheath), *BH*14, 4.5 per cent. error.

*Steering Competition*

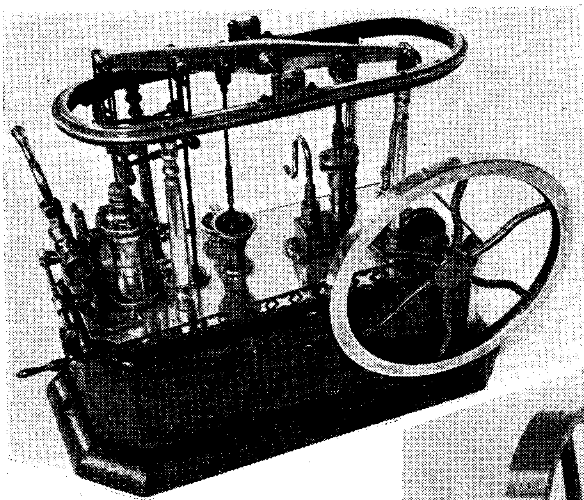
(1) J. Chandler (Southend), *Iope*, 13 pts.
(2) E. Vanner (Victoria), *Leda III*, 11 pts. + 5.
(3) J. Burgess (Cheltenham), *Lady Maud*, 11 pts. + 3.

(*Continued on page* 65)

*B. Pilliner (Southampton) starting his new flash steamer "Eega Beva"*

# THE 1953 SHEFFIELD EXHIBITION

**Reported by " Northerner "**



*This model beam-engine, probably over eighty years old, has been reconditioned by W. Cuckson*

THIS year's exhibition organised by the Sheffield and District S.M.E.E., did not contain so many exhibits as some of their past shows, but the quality of craftsmanship was as good as ever.

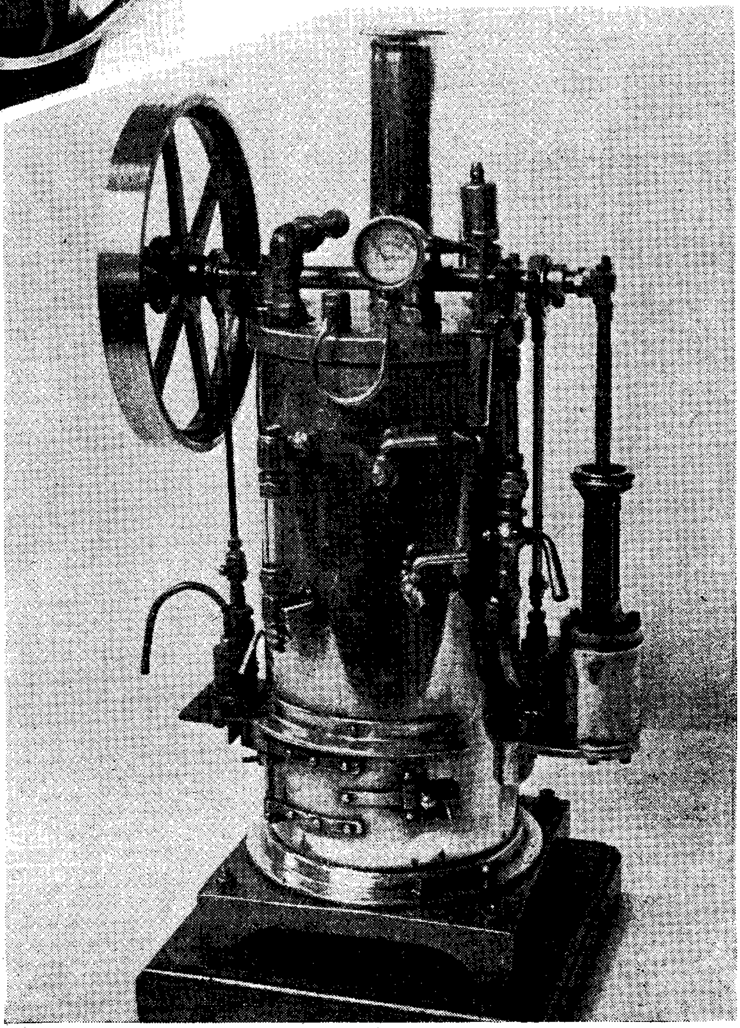
The model which "ran away" with the chief prizes was P. Thompson's well-nigh perfect steam tug; it won the Championship Cup and the President's Cup of the Sheffield S.M.E.E., and the Open Championship Trophy of the Sheffield Ship Model Society, as well as first prize in its class. However, I believe that Mr. Thompson himself intends later on to submit a descriptive article to the editor, so we will not steal his thunder here, except to say that this magnificent model well deserved its success.

**Young Exhibitor**

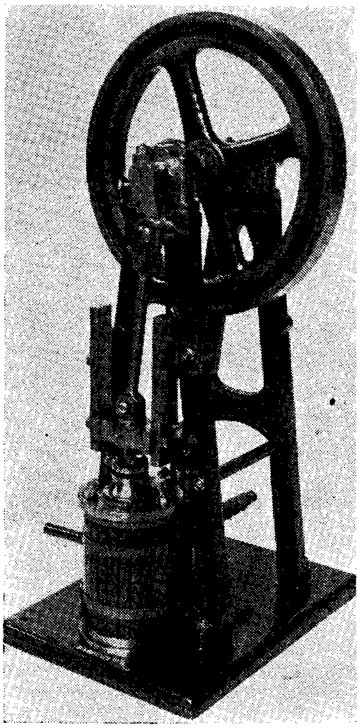
The youngest exhibitor was M. Barry Edge, who at the age of *five* had built a pretty little model of a Thames sailing barge. In this, the initial fret-sawing out of the hull had been done by his father, as had one or two other operations demanding the use of keen-edged tools, but the bulk of the work had been done most creditably by the youngster himself. This model was given a Special Merit Award.

Barry's father, F. W. Edge, won the originality Trophy of the Sheffield S.M.S. for his 13th-century ship of the Cinque Ports. This model, with its three castles at bows, masthead, and stern, apparently had a solid hull, but the deck-planks were separately—and accurately—laid. The castles were gaily decorated in red and white, and the fittings included an anchor, an eight-pointed grapnel, a skylight and hatch.

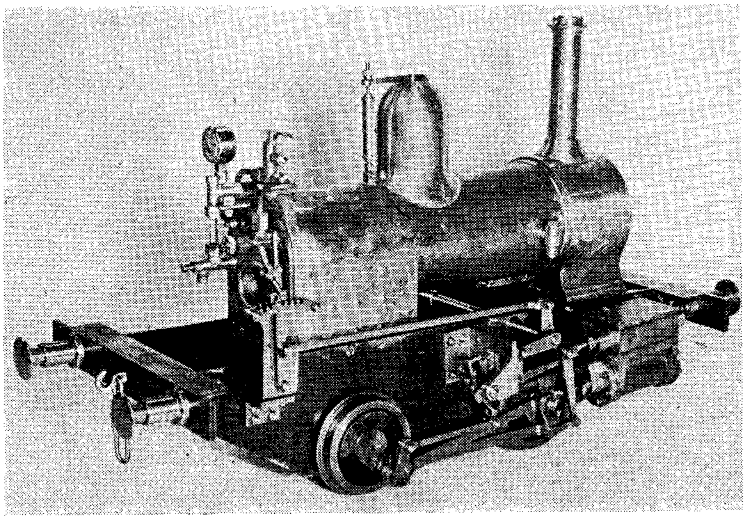
A vessel of which I had heard, but never seen before, was an R.N.L.I. tubular lifeboat, built to



*Another old model, a donkey-engine, purchased and reconditioned by Mr. Cuckson*



*This well-built inverted vertical steam engine,* 16 *in. tall, was built by the late D. E. Haywood*



*" L.B.S.C.'s " " Tich " ; and example of good craftsmanship by A. B. Langley, of Sheffield*

½-in. scale by the Rev. A. Everall. The " hull " of this boat consists of two tubes, curved and narrowing at the closed ends, with cross-beams between. Over these beams slats are laid to form an open grating. The vessel is steered by tiller, and the rudder is hinged vertically to its stock, with a rope attached by which it can be lifted out of harm's way when the vessel is beached.

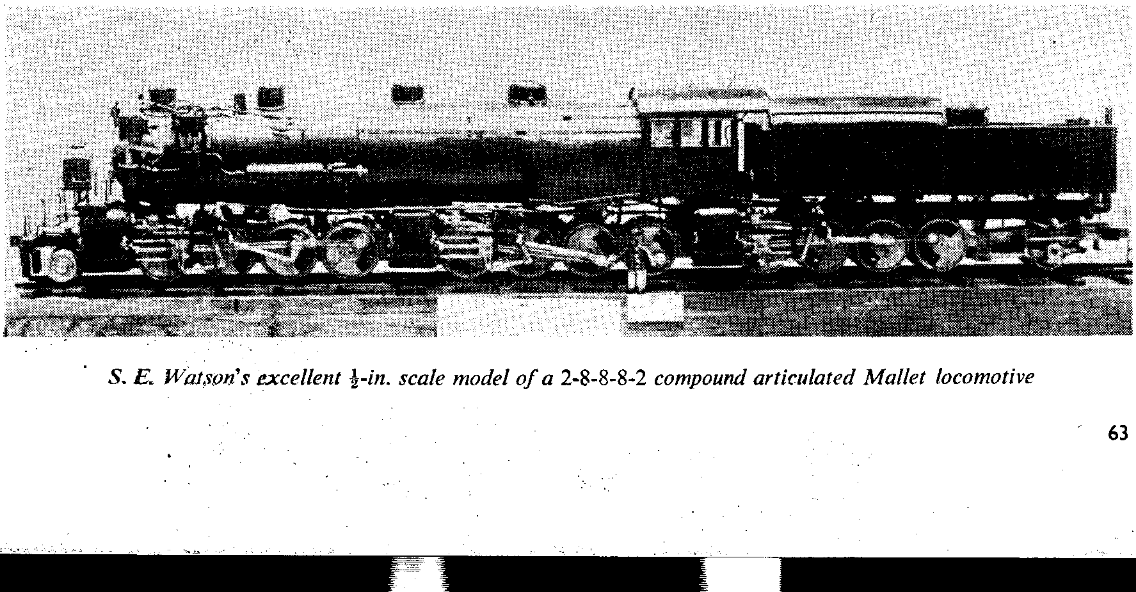
The design is now obsolete, but I was surprised to know that Mr. Everall's prototype was in use as late as 1939. It was stationed at Rhyl for the 43 years from 1897 to 1939, during which it was launched on service 17 times and saved 10 lives. The hull length was 34 ft., and beam 8 ft. 9 in. This model received the Accuracy Cup.

Several steam engines were exhibited by W. Cuckson, of Rawmarsh; these were mostly reconditioned by Mr. Cuckson from old models that he acquired from various sources.

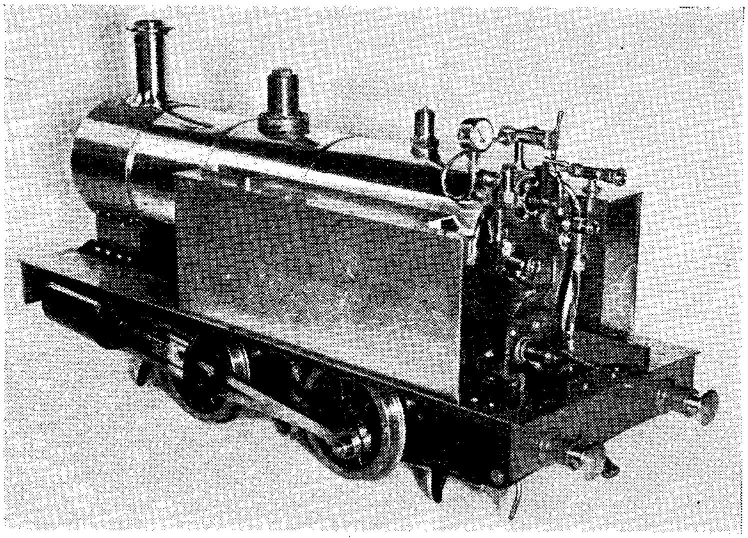
One of these was a very old beam engine, chiefly built in brass, which was literally a wreck when Mr. Cuckson started on it. It is fitted with Watt's parallel motion, and gab valve gear; the flywheel has bent wire spokes which are cast into both the boss and the rim. The model works cheerfully on 3½ p.s.i., and was in motion under compressed air for much of the period of the exhibition.

Another " rebuild " was a donkey engine, also in brass. The cylinder, ¾ in. by 1¼ in., is mounted on a bracket attached to the firebox, and drives upward to an overhung crank, the shaft revolving in bearings carried on the boiler top. The feedpump is on a bracket at the other side of the boiler, and boiler fittings include a Salter-type safety-valve, a whistle, water-gauge, and " high and low level " cocks. An interesting model typical of the engines that used to do such yeoman work in dockyards and similar places.

The N.A.M.E. had sent along several models, among them a number built by the late D. E. Haywood, whom I mentioned in



*S. E. Watson's excellent ½-in. scale model of a* 2-8-8-8-2 *compound articulated Mallet locomotive*



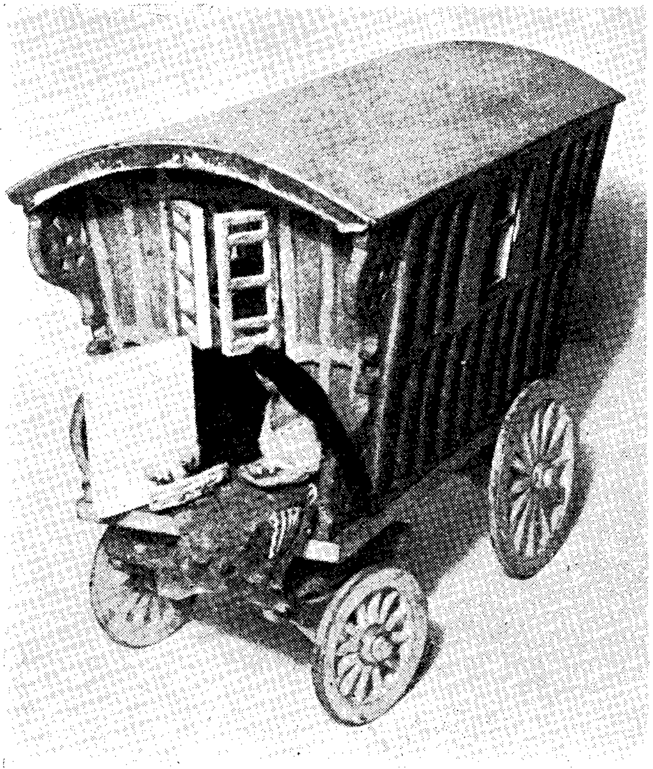
*Another piece of good work to "L.B.S.C.'s" words and music: J. Hatherley's "Juliet"*

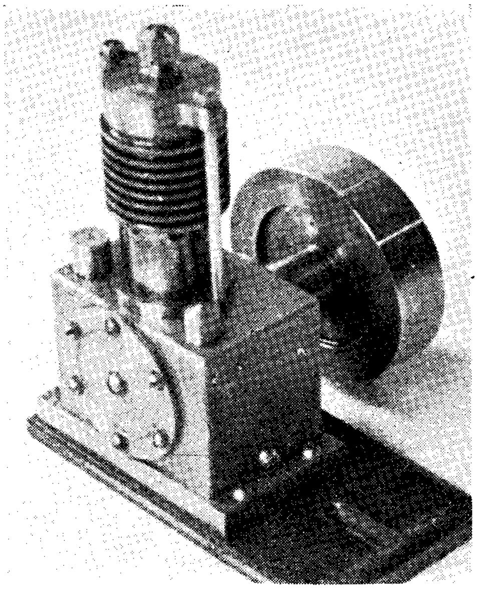
my report of the Manchester exhibition. One of these was a fine inverted vertical engine, of about $1\frac{1}{4}$ in. bore by $1\frac{1}{2}$ in. stroke, with a flywheel 8 in. in diameter. This engine had a strap and cotter type big-end, and the crosshead was fitted with bronze slippers; the finish of both brightwork and painting was excellent throughout.

Winner of the first prize in the locomotives was S. E. Watson of Sheffield, with his very impressive 2-8-8-8-2 compound articulated Mallet locomotive. Some six years have been spent in building this locomotive, which is to $\frac{1}{2}$-in. scale, and is complete in all detail, including the many pumps, lamps, domes, and other bits and pieces which are a prominent feature of most American locomotives.

The craftsmanship displayed by A. B. Langley in his unfinished *Tich* is typical of that which gained him the Championship Cup at Sheffield two or three years ago. Little need be said about the locomotive itself, since it is almost entirely to "L.B.S.C.'s" words and music, but certainly this is a very pretty design. Incidentally, Mr. Langley is also building another of the maestro's locomotives, *Petrolea*, and has nearly completed the chassis, which was on view.

Another "L.B.S.C." locomotive was the *Juliet* being built by J. Hatherley, also of excellent workmanship in all departments. This, too, is mostly to the standard design, but a departure is in the arrangement for dropping the fire-grate and ashpan. These are pivoted at the front end, and are dropped by means of a latch on the footplate.





*A small air-compressor built by T. W. Birch, of Sheffield*

*Left—This gipsy-caravan won the Novices' Prize for Miss J. V. Leach*

Mr. Hatherley is another fellow with two strings to his bow, the other engine on which he is working being an 0-6-2 of the old Manchester, Sheffield, and Lincolnshire Railway. This is being scaled down from an original " company " drawing.

Mention of the locomotives would be incomplete without R. Kerry's *Atlas*, which was in steam on the passenger track throughout the four days of the exhibition. This hard-working inch-scale tank engine, which was fully described by " Hallam " in THE MODEL ENGINEER last year, has hauled many thousands of passengers and travelled hundreds of miles in her six or seven years' life, but " keeps on keeping on " cheerfully and willingly. And so does her builder !

Reg Kerry is also building a passenger-carrying steam-wagon, for a change. This is a free-lance effort, but is based in appearance on a Sentinel belonging to a local brewery. However, instead of having a four-cylinder poppet-valve engine set across the chassis, with shaft-drive, as in the prototype, the model has a two-cylinder engine, $\frac{5}{8}$ in. bore by 1 in. stroke, with slide-valves operated by slip-eccentric reversing-gear. The crankshaft drives a countershaft, on which is the eccentric for the water-pump, by reduction-gears, and a second countershaft is driven from the first, also through reduction-gears.

On the second countershaft is a dog-clutch to connect the drive to a sprocket from which a roller-chain drives the rear axle. The clutch can be engaged or disengaged by means of a lever projecting through the side of the chassis.

The Ackermann steering is linked to a vertical lever which sticks up just behind the boiler and cab, and the wheel in the cab is simply a dummy. The firetube boiler has 32 tubes, and is fired through a chute from the top, as in the prototype. However, realising that it would be next to impossible to *light* the fire from the top, Reg has fitted a fire-door of the conventional type in the side of the boiler, below chassis level.

**Other Models**

The first of these is a very nicely-made model of a gipsy-caravan by a sixteen-year-old schoolgirl, Miss J. V. Leach, who was awarded the Novices' Prize. The model is not yet finished—the shafts and tool-box have still to be made—but it displayed some accurate work in fret-sawing and fitting. If the painting comes up to the same standard, Miss Leach will eventually have a handsome and realistic little model with which to ornament her dressing-table or tallboy.

Finally, the neat little air-compressor built by T. W. Birch. This is of perhaps, $\frac{5}{8}$ in. bore by 1 in. stroke, and was built chiefly to work a small steam-engine. The crankcase was home-cast from melted-down Dinky toys, which machine excellently, and the cylinder is turned from solid bronze. Finish is excellent throughout, and so is the fitting—the piston works easily in the cylinder, but the " compression " is very good, and, driven from the lathe countershaft, the compressor easily raises and maintains pressure in a fairly large receiver, as I have seen for myself.

*(To be concluded)*

# MODEL POWER BOAT NEWS

*(Continued from page 61)*

*500 yd. " C " Restricted Race*
(1) W. Everitt (Victoria), *Nan II*, 63.9 m.p.h.
(2) L. Pinder (S. London), *Rednip 7*, 56.8 m.p.h.

*500 yd. Class " C " Race*
(1) C. Stanworth Sen., *May II*, 37.08 m.p.h.
(Only one finished.)

*500 yd. Class " B " Race*
(1) J. Bamford (Aldershot), *Jab III*, 51.14 m.p.h.
(2) G. Lines (Orpington), *Sparky 3*, 46.08 m.p.h.

*1,000 yd. Class " A " Race*
(1) E. Clark (Victoria), *Gordon 2*, 51.66 m.p.h.
(2) J. Innocent (Victoria), *Betty*, 50.18 m.p.h.

**Welling and District Regatta**

The boating section of the Welling club is much handicapped by lack of a suitable water, but each year a regatta is held at the pond near the " Eardley Arms," Erith.

This pond is unsuitable for circular course racing, owing to the remains of a fountain which decorates the middle. However, a good show of straight-running boats is usually forthcoming, and this year was no exception. Besides the steering, nomination, and team relay events, a radio-control competition was added this time. The latter took the form of a " two-part " contest, in which, first each boat was given four minutes to pick up as many floating dolls as possible (these are weighted to float upright and are fitted with a hook in the head ; the boats have an arm projecting with a hanging loop). The second part of the contest was to burst as many floating balloons as possible in two minutes. The first and second prize-winners in this somewhat spectacular event were both from the Bromley club—R. Curwen, with *Vanessa*, and G. Caird with *B.O.A.C. 51*. Incidentally, both of these boats function well as steering boats, when not under radio-control.

The nomination event produced a tie for first place—both with nil error ! J. Chandler (Southend), with *Iope II*, and S. Dearling (Blackheath), with *Maj*, were the competitors involved, and another run was necessary to determine the winner.

*Leda III* was the winner of the steering competition—no need to mention who the owner is ! A tie for third place between L. Gates (Victoria), with *Squib II*, and J. Chandler, with *Iope*, resulted favourably for the steam launch.

**Results**

*Nomination Race*, 40 *yd.*
(1) S. Dearling (Blackheath), *Maj*, .5 sec. error (after tie).
(2) J. Chandler (Southend) *Iope II*, 1 sec. error (after tie).
(3) J. Slender (Welling), *Sarah Ann*, .75 sec. error

*Steering Competition*
(1) E. Vanner (Victoria), *Leda III*, 13 pts.
(2) F. Curtis (Kingsmere), *Korongo*, 7 pts.
(3) L. Gates (Victoria), *Squib II*, 6 pts.

*Team Relay Nomination*
(Three boats per team)
(1) Kingsmere : F. Curtis, C. Morgan, J. Thomas—Error nil.
(2) Welling : J. Slender, V. Lambert, A. Clark—Error 3 sec.

*Radio Control*
(1) R. Curwen (Bromley), *Vannessa* : Dolls 6, Balloons 3.
(2) G. Caird (Bromley), *B.O.A.C. 51* : Dolls 3, Balloons 1.

The photographs illustrating this article were taken by Mr. E. Clark.

# MORE UTILITY STEAM ENGINES

## *By Edgar T. Westbury*

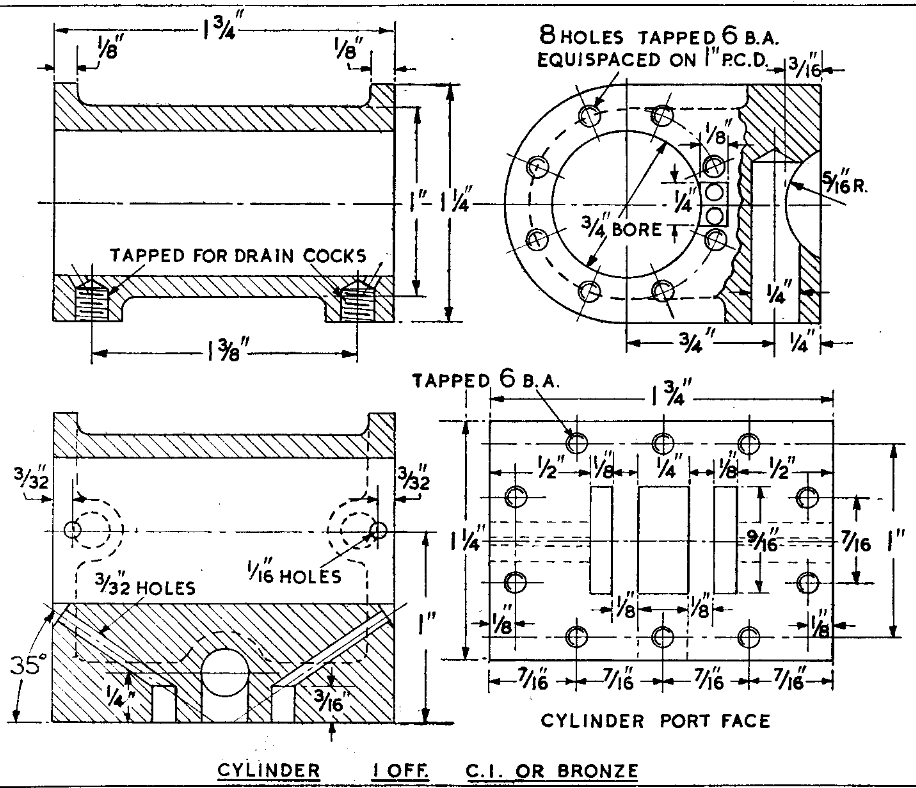
TO complete the operations on the cylinder support bracket, the casting is now mounted on an angle-plate, and set up on the faceplate for boring and facing the cylinder seating. Make certain that the slideway is set square with the face-plate—it would be worth while to fix an aligning strip to the angle-plate to ensure this, and it could be held on by the bolt used to clamp the casting in place, but located and squared up before the latter is put in position. The position of the seating centre should be carefully marked out, the height being measured from the base surface, and the intersection of this line with the vertical centre-line, already marked, centred accurately by moving the angle-plate on the faceplate. Centre-drill, bore and face the end surface to the dimensions given, and after removing from the angle-plate, mount the casting in the reverse position on a spigot mandrel for facing the inside of the recess. A boring-tool long enough to reach from the end of the foot, or a facing-cutter applied from the tailstock, may be used for this operation, the object of which is simply to provide a true face for the nuts which hold the cylinder in position.

A flat face on the top edge of the bracket must be provided to form a seating for the governor frame; this can be machined by clamping the casting to the faceplate by a bolt through the slideway-slot and using a facing-tool; centring is obviously unnecessary. All that remains to be done on this component is to drill and tap holes, and cut off the bridge piece from the foot.

### Cylinder

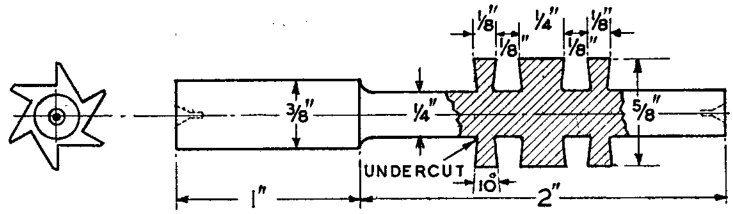
The group of components which form the cylinder and steam chest assembly of the " Unicorn " engine are of a type with which most readers are familiar, as similar components have been described in detail many times in THE MODEL ENGINEER, so that the methods of machining them are well known. However, on the principle that there are more ways than one of exterminating a domestic mouser, I am describing my own methods of carrying out these operations, which may differ in some details from those usually employed, and constructors may take their own choice.

First, in respect of materials; nearly all small steam engine cylinders are made in that delightfully




CYLINDER 1 OFF. C.I. OR BRONZE

*Continued from page* 12, *July* 2, 1953.




*Cutter for milling all three cylinder ports simultaneously*

vague material known as "gun-metal"—which in practice may mean nearly anything. So far as my information goes, the term apparently originates from the days when heavy cannon were commonly cast in bronze—a simple copper-tin alloy, in other words—and applied particularly to the melted-down guns captured in the Crimean war, from which, I believe, the Victoria Crosses are still made. Nowadays, it may mean anything from a cocktail mixture of brass fenders, gas fittings and a dash of bearing metal, to an alloy so refractory that the machinist may be led to believe that the recipe for the ancient legendary and near-magical metal which would "cleave Damascus steel in twain" has been accidentally rediscovered. I have preferred to use the term "bronze," which also covers a wide range of alloys with equally varied properties, but is not quite so indefinite as "gunmetal." The harder varieties of bronze, containing phosphorus or manganese, for example, are noted for their resistance to wear, but it should be observed that they do not always retain their special properties when used to make castings, as these constituents will not survive re-melting indefinitely.

Large engine cylinders are, of course, rarely made in bronze, the cost of which alone would be a serious disadvantage, but cast-iron, which is almost universally employed for this purpose, is by no means an inferior substitute, as its wearing properties are at least as good as bronze, particularly at high temperatures, and if initially bedded down with adequate lubrication, it acquires a hard glaze on the surface which ensures long life and reduces friction. Anyone who has had to re-machine a large steam engine cylinder, or re-face a slide-valve, after a long period of service, can confirm this.

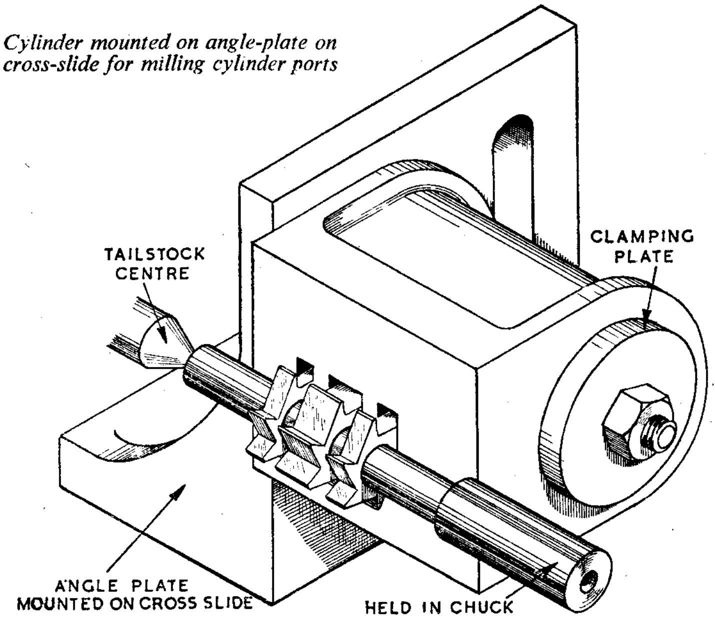
In small engines, cast-iron cylinders are often objected to on the grounds that they are liable to rust, but with reasonable care, and normal internal lubrication of the cylinders, little trouble is encountered in this respect. However, readers may use either iron or bronze, as they prefer; but mild-steel is not a good material for steam cylinders, neither is aluminium alloy in any of the forms normally available.

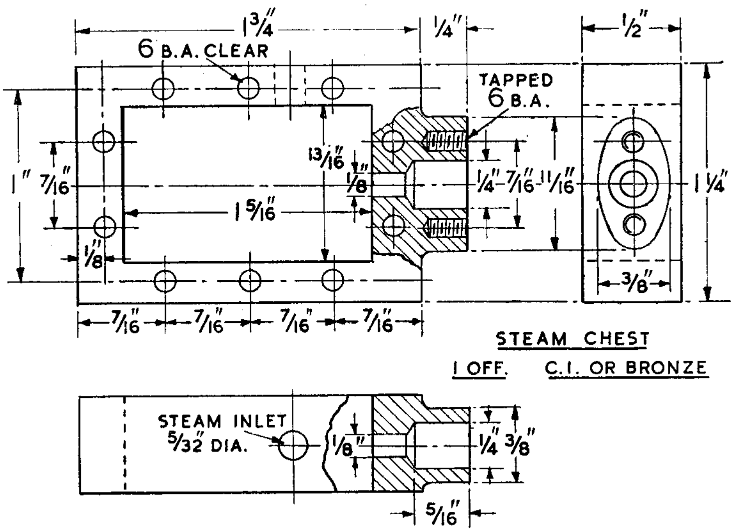
My method of machining the cylinder is as follows: The casting is first marked out to indicate the centre-line of the bore, using plugs or "bridges" in the ends of the cored hole to enable this to be done; there is a possibility that the core might be displaced from the true centre, so assuming that there is adequate machining allowance, it should be disregarded, and measurements taken from the edge of the flange in each case. The distance of the port face from the cylinder centre should be marked, and a line scribed all round to indicate the amount to be machined away.

The casting is then held crosswise in the four-jaw chuck, with the port face outwards, and the machining line set parallel to the chuck face. It is then machined with a facing tool to produce a perfectly true flat surface, though not necessarily right back to the line at this stage; as the face might possibly get damaged before the job is finished, there is some advantage in leaving a little metal to be dealt with in a subsequent finishing operation. An angle plate is used to mount the casting for machining the cylinder bore, the machined face being placed in contact with the plate, preferably with a thin piece of paper interposed, and held down with a bridge clamp or strap, which should bear on the end flanges, not the reduced diameter in between. A vee-packing block is an advantage, as it produces a three-point contact, which resists side slip better than a flat clamp. It is then carefully squared up and centred for the boring operation.

The end face of the cylinder is machined to bring the flange to correct thickness (check the distance between the flanges on the casting, and in case this may not be correct, split the difference) and the inside bored out to within about 0.002 in. of finished size, taking care to obtain as smooth a finish as possible, and dead parallel. Some constructors use a reamer for finishing bores, but there is some risk of getting them out of circular accuracy, especially if the reamer should tend to snatch or chatter. I prefer to rely on a single-point boring tool, followed by lapping, but the latter should not be done at

*Cylinder mounted on angle-plate on cross-slide for milling cylinder ports*






STEAM CHEST 1 OFF. C.I. OR BRONZE

the present stage. Steam engine cylinders do not necessarily require such a high degree of precision as those of i.c. engines, but the more accurate they are the better, and time spent in getting them correct will be well repaid in engine efficiency.

To machine the reverse end face of the cylinder, it should be mounted on a true-running mandrel, care being taken to avoid scoring the bore, either lengthwise in inserting or removing the mandrel, or in rings due to slipping. I often use graphite grease to lubricate mandrels, and find it helps to avoid this risk. The casting is then once more mounted on the angle-plate, by means of a single bolt through the bore and a plate on the end face, with paper washers at each end, and the port face set exactly square with the faceplate. This enables the edge of the port face and also the cylinder flange to be machined true, and parallel to the cylinder bore; the process is repeated for both top and bottom faces. It may be remarked that these operations are optional, as these faces do not necessarily need machining, but they very much assist in getting things accurate and also improve the appearance of the finished cylinder.

**Steam Chest and Cover**

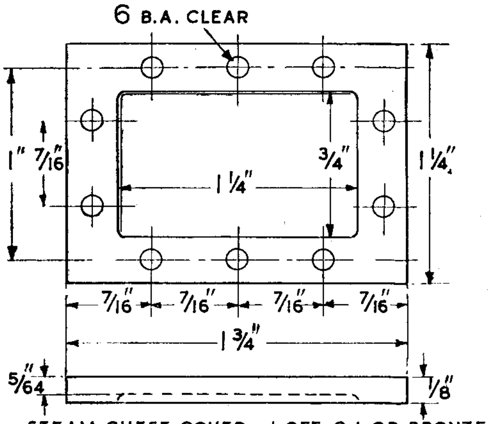
Although the work on the cylinder is not entirely completed, it is a good idea at this stage to leave it for the time and start on the steam chest. The operations on this are fairly simple, the most important being the facing of the two sides, which can be done by holding it in the four-jaw chuck, but after one side has been dealt with, some care is necessary in re-setting it to ensure that the second side is exactly parallel with the first. This can be done by using a parallel packing block behind the work, of such a thickness as to enable the face to be machined, when it is bedded firmly and evenly against the packing. Another method which I have found useful, especially in small work where chucking is difficult, is to use a " solder chuck," i.e. a flat brass plate bolted to the faceplate, and machined on its face, after which the work is sweated to it with soft solder, under clamping pressure to avoid risk of an uneven solder film. It can then be machined on the front face, and finally unsweated and cleaned off.

The same general methods can be used in facing the steam chest cover, the inside being the important face, though the outer one should also be as flat as possible, apart from the relieved centre panel, to enable the nuts to bed down truly. With both these components, and indeed in all facing operations on joint surfaces, the flatness of the finished face should be verified, as some lathes may not be as accurate as they should be, in respect of the squareness of the cross-slide saddle with the axis of the mandrel, and may therefore tend to produce a concave or convex surface. Slight errors, however, may be corrected by scraping or lapping. Incidentally, I may mention that it is also assumed that angle-plates are square, and faceplates or chuck bodies run truly ; these details are easily checked, and should never be taken entirely for granted.

Before going further, it is a good idea to drill the stud holes in the steam chest and cover, and fix them temporarily together for trueing the edges. The former should be drilled first, and used as a jig for the cover, as the greater length of the hole gives better guidance to the drill. I also prefer to drill the holes tapping size at first, and open them out later; two or more of the holes in the steam chest can be tapped to take temporary screws for holding the parts together while machining. Alternatively, they can be dowelled with close-fitting pins in the holes to preserve relative location.

Regarding the number of stud holes in these items, the constructor concerned only with utility may consider that there are more than are really necessary. Certainly the joints could be held against any reasonable working pressure with a smaller number of studs, but if one has any regard for realism, the number shown should be adhered to. The least number which could be recommended is eight, with a spacing of approximately $\frac{9}{16}$ in. between each, so one would not save much. Similarly, the eight studs in each cylinder cover could be reduced to six. It is, of course, assumed that all the joint faces are true; if they are not, twice as many studs would not assure steam-tightness.

It is in details such as these that one must decide whether to adopt the simplest forms of construction or try to make the model look

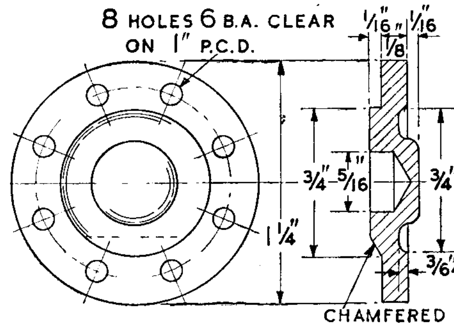



STEAM CHEST COVER 1 OFF. C.I. OR BRONZE

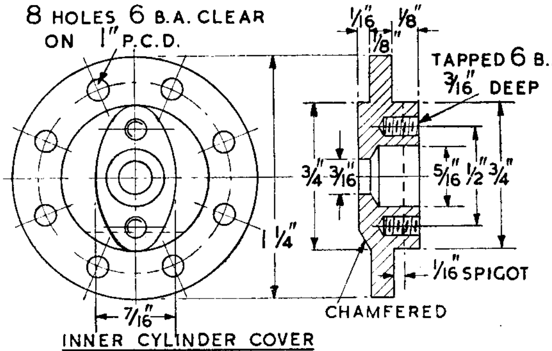
something like the real thing. Very likely the engine would work just as well if put together with the minimum number of bolts, screws or other fixings; I very much doubt whether it would work any better. Simplification in this respect may be fully justified in an engine installed in a speed boat, for instance, which is not easily accessible and may have to be serviced in a hurry; in such a case a multiplicity of finicky bits is a nuisance, and may even affect the success or failure of the plant in its working capacity. But there is little excuse for economy of parts in a model in which appearance is an important consideration.

The steam chest and cover, fastened together, may now be mounted on an angle-plate by a strap and bolts, and the sides and ends faced square, and to match the dimensions of the cylinder port face; at the gland end, the centre of the boss must be set to run truly for drilling, counterboring and facing. The inside of the steam chest cannot be machined unless one has some means of carrying out slotting operations, but it will probably need filing out to give ample space for the movement of the slide-valve.

The cover of the steam chest may now be removed, and the steam chest clamped to the cylinder to form a jig for the tapping holes in the latter. Make certain that the contact face in this case is the opposite one to which the cover was attached, also that the gland is at the right end in relation to the cylinder. It is unlikely that the average constructor will attain sufficient "tool room" precision in the location of the holes to enable the steam-chest to be assembled "four ways"—I confess that I have rarely done so when using the ordinary methods of marking out, but it is not necessary for work of this nature.




OUTER CYLINDER COVER
1 OFF C.I. OR BRONZE




INNER CYLINDER COVER
1 OFF C.I. OR BRONZE

## Cutting Cylinder Ports

Here again there is a choice of methods, and so long as the desired results are achieved, it does not matter which method is used. The ports shown on the drawing are much larger, in proportion, than those on the full-sized engine, and the engine would do the work for which it is designed on much smaller ports, but by making them large, it is much easier to produce them, and so far from being a disadvantage, even for a low power engine, they make certain of getting the steam in without wiredrawing, and extracting the exhaust without back pressure.

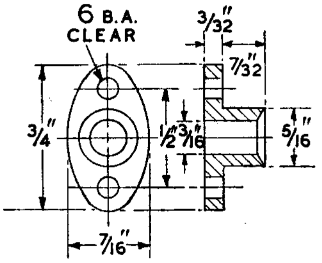
A method of cutting the ports which I have employed with success on several of my steam engines, and which can be recommended in the present case, is to use a side milling cutter, which must be integral with its shank, similar to a Woodruff key-seating cutter, but having a much greater length of its shank reduced to minimum diameter. It is thus necessary to make a special cutter, but this is not a difficult or lengthy operation. Silver-steel is a highly suitable material, and the size employed is $\frac{5}{8}$ in. diameter. While it is practicable to use a single cutter, of a width equal to that of the narrowest port, and traverse the work as required to cut the ports in the desired location, it takes very little longer to make a "gang" cutter, to cut the three ports at once to full width and accurately located. The time spent in making this cutter will by no means be wasted, as it will almost certainly be useful when making other steam engines in the future.

The silver-steel rod should be chucked as truly as possible, and the shank portion, the outer extension, and the grooves between the cutter discs all reduced to $\frac{1}{4}$ in. diameter or a little less, the sides of the discs being undercut as shown to give clearance for the teeth. About six teeth will be quite sufficient, and they need not be evenly spaced; the flutes should be cut so as to leave a narrow land, or "witness" at the tip, which is oilstoned after hardening to give the cutting clearance; the face of the tooth, which should be as near as possible exactly radial, being similarly treated, using a small triangular slipstone. Hardening is best carried out in oil, or in water with a film of oil on the top, as this reduces the risk of surface cracks. The shank and outer extension are then "let down" by reheating, grading the heat so that these are as deep a colour as possible, but the cutting portion should not be allowed to go beyond a medium straw colour.

If a vertical slide is available, the cylinder may be set up on this, using a small machine vice, or any other convenient method of mounting, with the axis parallel to that of the mandrel, the port face being vertical, and symmetrical about centre-height. The cutter may be run either between centres, or in the chuck with back centre support, the latter being preferably, providing it runs truly, as it ensures better rigidity. The adjustment of the work to locate the ports correctly can be checked by measurement from the two ends of the cylinder; a slight error in this respect is much less important than an error in the *relative* port locations. Cutting ports by this method is very rapid, once the work is set up, and the accuracy and cleanness of the port edges are beyond reproach, but the depth of port obtainable is limited. The cutter should be run in as deep as possible without the shank actually rubbing; to avoid this, a slip of cigarette paper may be stuck against the port face, beyond the ports, with a little thick oil; it will be whisked away when the shank makes contact.

It will be seen that the exit passage

from the exhaust port is a $\frac{1}{4}$ in. hole drilled vertically from the underside of the cylinder ; it is advisable to drill this before cutting the ports, otherwise there may be a risk of breaking the drill or causing it to deviate when it runs tangentially into the port. The drilled holes communicating with the cylinder bore, however, are best dealt with after port cutting, and if the vertical slide is in use, this only entails slewing the slide round so that the port face is at an angle of 35 deg. to the lathe axis, milling the angular



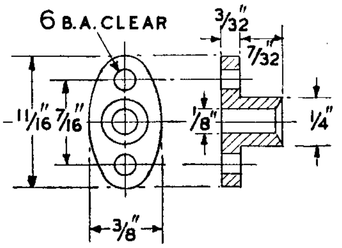

PISTON ROD GLAND
1 OFF BRONZE

seating, and displacing the work vertically for drilling the two holes. A small centre-drill should be used to ensure that the drill starts truly, which reduces the risk that it may wander from the straight and narrow path, and it is also a prudent policy to drill an undersize hole first in case of accidents. If the vertical slide has an index on the feed screw, it should be raised $\frac{1}{16}$ in. (0.062 in.) above the centre for the first hole, and the same amount below centre for the second, allowing for backlash in each case. The procedure is, of course, repeated for the other end of the cylinder.

Should no vertical slide be available, it is quite possible to carry out all these operations effectively, though not so conveniently, by clamping the cylinder to the vertical face of an angle plate mounted on the cross-slide, using a single bolt, with clamping plate, through the bore. The height in this case must be adjusted by slackening the bolt and tapping the work up or down ; alternatively, the cylinder may be bolted down to the cross-slide directly, with packings of suitable thickness under the edge of the port face ; the advantage of machining these edges square will be apparent when this method is employed.

**Cylinder Covers**

These are fairly straightforward machining jobs, which should be machined all over at one setting, as far as this is possible ; the use of chucking pieces on the castings will be helpful in this respect. In order to fit the spigot properly to the cylinder bore, it is necessary to finish the lapping operation on the latter first, to arrive at the correct size. The outer cover is best machined on the inner surface first, the outside being relatively unimportant for accuracy ; but the inner cover must be true and concentric on both sides, so it is best to machine the outer surface, including drilling and counterboring the gland, and




VALVE ROD GLAND
1 OFF BRONZE

turning the spigot to register in the bore of the support bracket, then mounting it on a pin mandrel, turned in the chuck to fit both diameters of the hole, to machine the inner face and spigot.

The bolting holes in the covers should be located as accurately as possible, and the advantage of a milling spindle which can be quickly set up on the lathe cross-slide is beyond dispute for this purpose, especially in conjunction with some form of mandrel indexing device. If the holes are drilled, or at least started, with a centre drill, while the work is set up for turning, they cannot help but be concentric to the pitch line, and the indexing gear will ensure that they are equally spaced. It is best to drill them from the inside surface to avoid excessive burrs. After drilling the covers, they may be clamped to the cylinder and used as jigs to locate the tapping holes. By employing these methods—plus due care and attention—it will be found that the covers will assemble eight ways when finished, but note that one side of the spigot on each cover must be chamfered to avoid blanking off the entry ports to the cylinder, and thus they can only be assembled one way, so they should be marked to avoid mistakes in this respect.

Cast-iron cylinders may be lapped with carborundum or other fast-cutting abrasives, at least for the first operation to remove tool marks ; but it is not advisable to use this in bronze cylinders, owing to the risk of embedding sharp particles, and softer abrasives such as brick dust or Cornish silica (the *solid* residue from a tin of liquid metal polish contains this) are safer, though they will not remove a great deal of metal. In either case, the bore may be finally polished with tripoli, plate powder or rouge. The use of solid or expanding laps is recommended, as described on several occasions in past issues of the "M.E." For flat surfaces, a piece of thick plate glass makes an excellent lap, and the same abrasives are used, the work being moved over as wide an area as possible, in "figures of eight," so that every part of the surface gets the same treatment. After cleaning off all the traces of abrasive the flatness of the surface should be tested on a surface plate or another *unused* piece of plate glass.

**Glands**

These may also be provided with chucking pieces, which enable the essential surfaces to be machined at one setting, including centring, drilling, reaming, turning the outer diameter and the face of the flange, and the internal bevel on the spigot face, which should normally have an included angle of 120 deg., but the exact angle is not important. The two glands are dealt with in the same way, as they differ only in dimensions ; they may be held in the chuck by the spigot for facing the outside of the flange. For drilling the holes, the use of a drilling spindle is again recommended, as it helps in locating them symmetrically to the gland centre, and they are then used as a jig for drilling the tapping holes in the cylinder cover and steam chest respectively.

A clean and shapely finish to the outside of the gland flanges is highly desirable ; in full-sized engines, a good deal of care is taken over this, and there is little excuse for badly shaped or roughly finished glands on a model, as they make the engine look very slovenly. If fairly accurate castings are obtained, it is only necessary to run a file round the edges of both the gland and its housing, temporarily assembled and held together by screws. But I have found good clean castings the exception rather than the rule, and have made a practice of machining glands from the solid, including at least a part of the flange contour. As the subject of flanges will crop up at a later stage, I shall have more to say on the matter then.

*(To be continued)*

# IN THE WORKSHOP

BY DUPLEX

# A LATHE MILLING ATTACHMENT

To obtain the reduction of $6\frac{1}{4}$ : 1 in the backgear drive, the sleeved pinion (*S*) drives a 50-T. wheel which is fixed to the sleeve (*Ua*) running on the layshaft, and a 20-T. wheel, fixed to the same sleeve, then drives the 50-T. bull wheel keyed to the main driving spindle. Making the sleeved pinion has already been described, and for the three remaining wheels, standard Myford change wheels were used.

To complete the driving shaft assembly, the bull wheel (*T*) is made a light press-fit up against the shoulder on the shaft, where it is secured in place by means of a Woodruff key.

*Concluded from page 25, July 2, 1953.*

**The Layshaft Assembly—(U)**

The $\frac{3}{8}$ in. diameter layshaft (*Ub*) is fitted at either end with an eccentric trunnion block, so that on rotating the shaft the gears are brought into mesh or disengaged, as the case may be. After the eccentrics have been machined to a working fit in the headstock bearings, they are set off-centre for 3/32 in. in the four-jaw chuck for machining the bores to a push-fit on the shaft. The drawing in Fig. 27 is reversed from right to left with reference to Fig. 3.

The right-hand eccentric, Fig. 27, is fitted with a small operating lever (*Uc*), attached with two screws, and its edge is filed or machined down to provide abutment faces for a stop-pin.

Secured to the left-hand eccentric is a 1 in. diameter disc, $\frac{1}{8}$ in. in thickness, forming part of the mechanism for locking the layshaft either in or out of engagement.

The two eccentrics are finally lined up in position and secured with set-screws engaging in dimples drilled in the shaft.

The cast-iron sleeve (*Ua*) is machined to a press-fit in the two layshaft gear wheels (*W*) and (*X*) and, in addition, Woodruff keyseats are cut for keying the wheels in place. An oil hole, closed with a grub-screw, is drilled and tapped at the centre of the sleeve for lubricating the bearing, and the sleeve is finally bored and lapped to a close running fit on the layshaft.

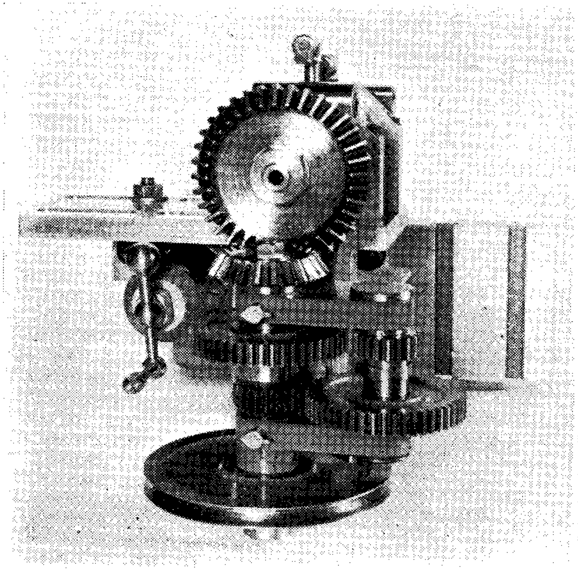
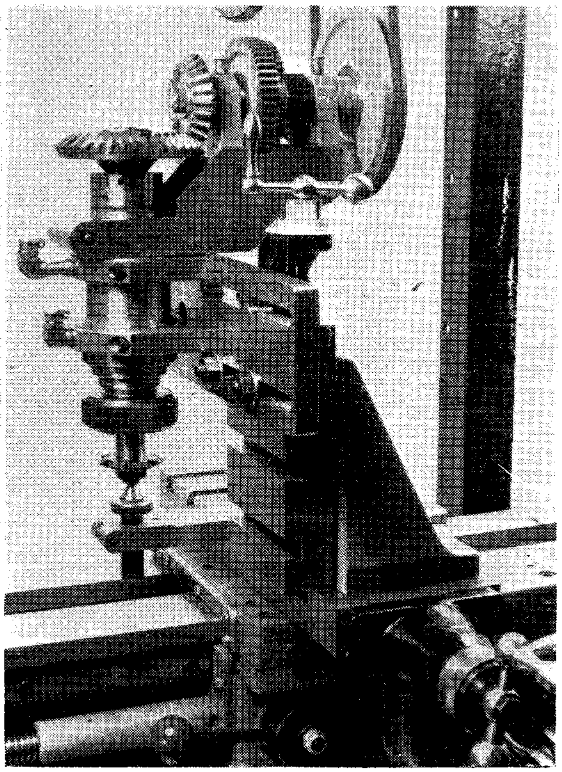


*Fig. 25. The backgear and bevel drive seen from above*



*Right—Fig. 30. The attachment mounted on the lathe cross-slide, showing the side plates*

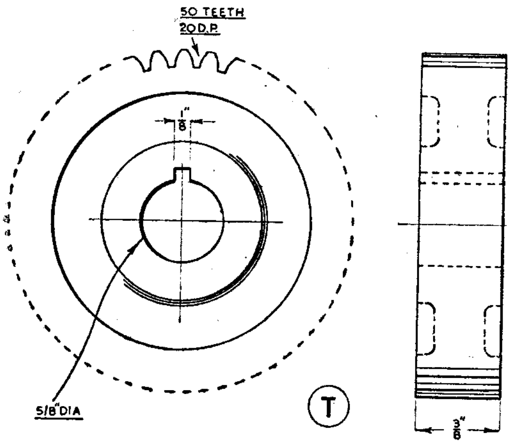



*Fig. 26. The bull wheel fitted to the drive shaft*

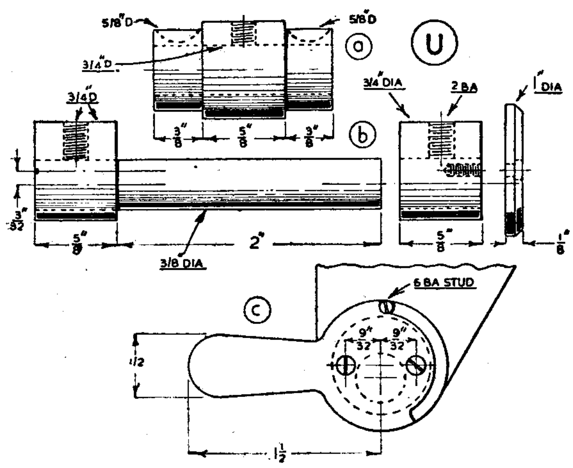



*Fig. 27. The layshaft assembly—U. The gear sleeve—a; the layshaft and eccentric mountings—b: the operating lever—c*

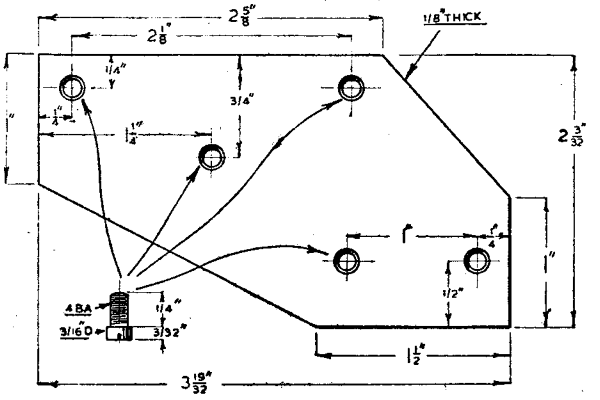



*Fig. 31. The headstock side plates*

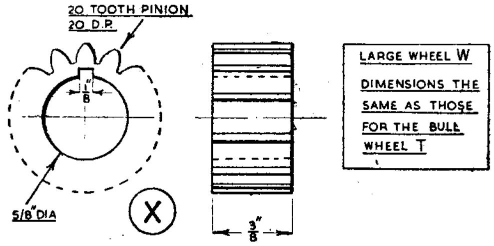



*Fig. 28. The layshaft gear wheels*

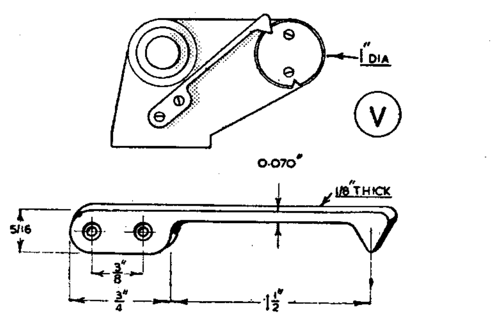



*Fig. 29. The layshaft locking mechanism*

The layshaft can now be assembled and mounted in the headstock bearings. After meshing the gear wheels so that they run smoothly, the front bearing plate is marked-out for fitting the 6-B.A. stud or stop-pin limiting the engagement of the gears.

The spring detent (*V*), Fig. 29, fitted to the rear bearing plate adjacent to the belt pulley, was filed to shape from a length of mild-steel strip and afterwards case-hardened to impart the necessary springiness. The spring is at first secured with a single screw, and the second screw is put in later after the working position of the spring has been found.

With the gear wheels correctly meshed, and with the operating lever bearing against its stop-pin, the notches are marked-out and filed in the detent plate to correspond with the in and out positions of the layshaft gear wheels; following this, the detent plate is case-hardened.

**The Side Plates**

As will be seen in Fig. 30, showing the attachment mounted on the lathe cross-slide, a plate is fitted on either side of the headstock assembly to serve as a brace.

The dimensions of the plates are given in Fig. 31, but here the plate on the opposite side is shown. Although 4-B.A. screws are specified for attaching the plates, 2-B.A. hexagon-headed screws can be fitted, if preferred.

When fitting the plates, it will be found that their upper edges have to be cut away in one place to clear the bull wheel, as can be seen in Fig. 13.

**A Wheel Guard for the Bevel Gears**

For safe working, and also to prevent oil throw, both the bevel gear drive and the backgear wheels are covered by wheel guards. The guard for the bevel gears is built up from 20-gauge tin plate. The lower portion is bent to shape on either a metal or a wooden former, and the

lid, after being cut out and bent in accordance with the drawing, is soldered to the lower part. The stirrup-shaped guard for the bevel pinion, together with the attachment lugs, is riveted in place and the joint finished by soldering.

The opening in the top of the guard gives access to the machine spindle where a draw-rod is used for securing a taper-shank arbor and, to give a finished appearance, a shouldered brass ring is fitted to the opening. A bush, carrying a knurled closing screw, is soldered in place in the lid to allow grease to be fed to the bevel gears. The finished guard is attached to the two side plates of the headstock with screws and, here, distance collars are needed.

To afford a three-point fixing, the lug attached to the stirrup is bolted down to an extension-piece, fitted in place of the lubricator for the front spindle bearing.

### The Backgear Wheel Guards

The construction of these guards should be made clear by the drawings in Fig. 33. Each guard has a tongue for attachment to one of the headstock side plates ; in addition, the two guards are braced by means of a

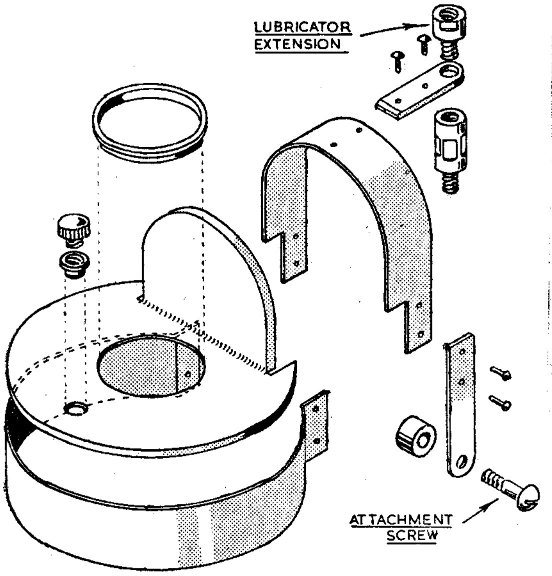



*Fig. 32. The bevel drive wheel guard*

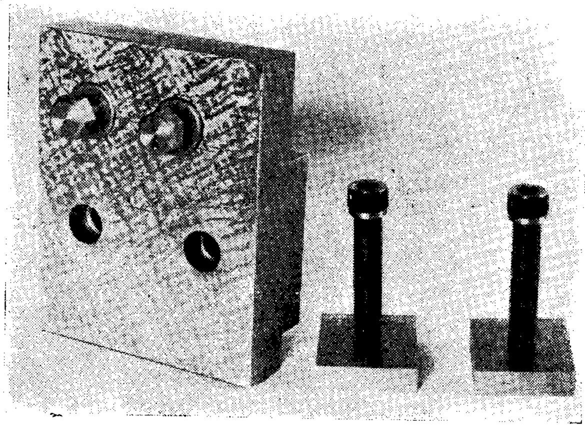


*Fig. 35. The lathe bed mounting plate and clamps*

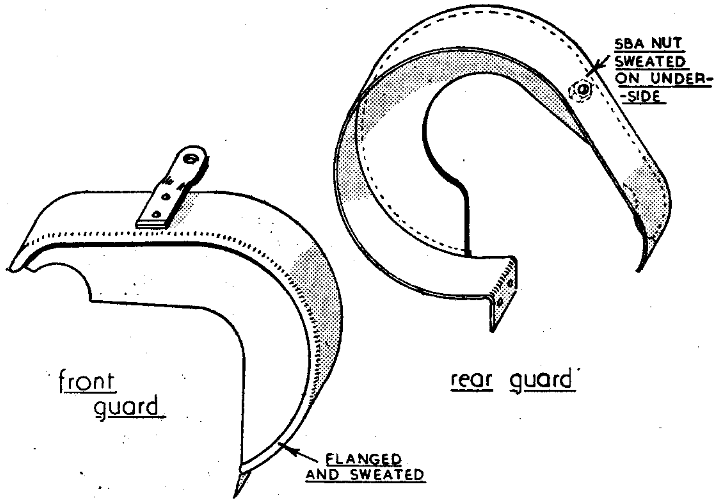



*Fig. 33. The wheel guard for the backgear*

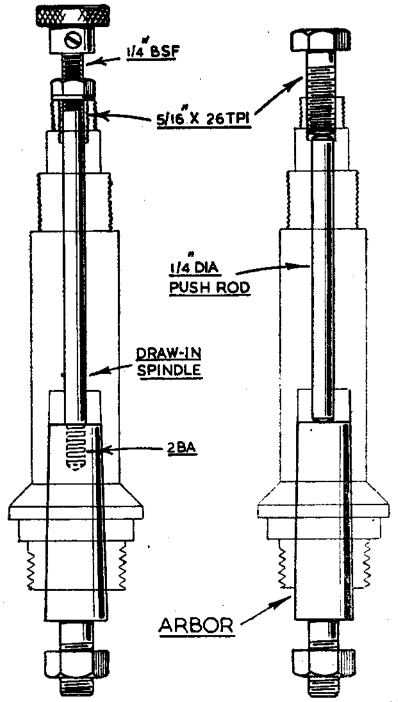



*Fig. 34. The spindle draw-rod and arbor ejector*

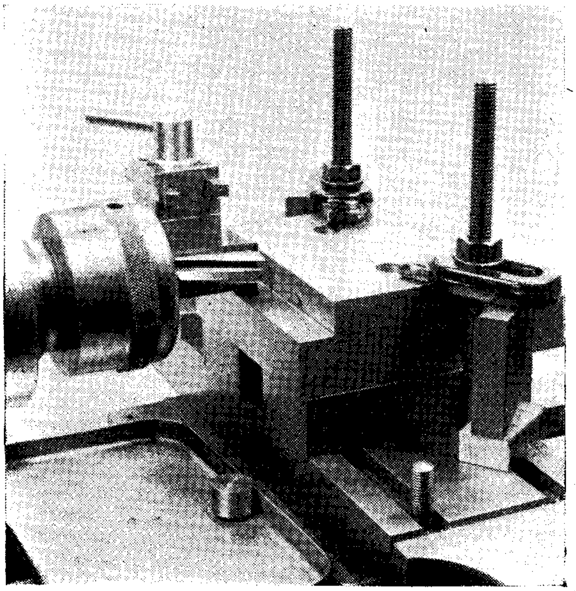
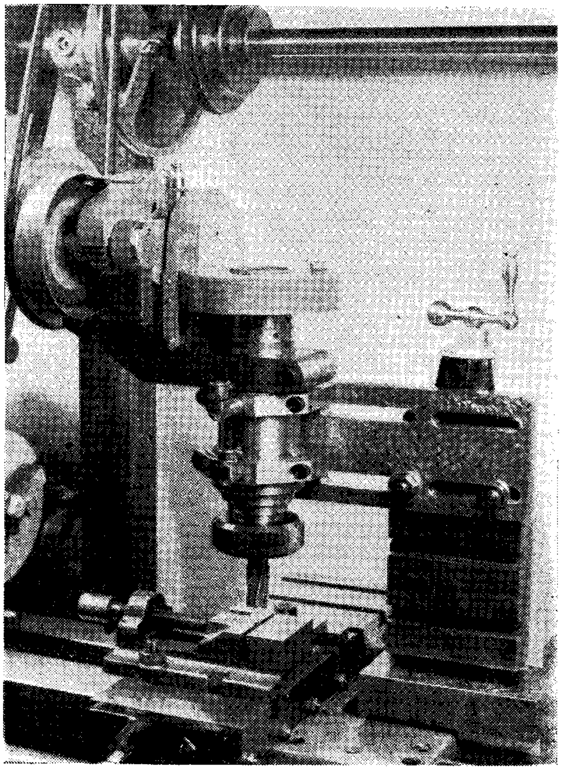


*Fig. 38. Machining the bedplate*



*Right—Fig. 39. The attachment mounted on the lathe bed*

connecting strip, riveted to the one and secured to the other with a screw fixing. Formers are, again, used for shaping the curved portions, and for flanging the edges before soldering the parts together.

**Lubrication**

To supply oil to the main bearings, the caps of the brackets holding the spindle housing are drilled and then tapped 2 B.A.; at the same time, an oil-way is drilled through the spindle housing and the bearing bush at either end.

The lubricators fitted throughout were obtained from Messrs. C. Weston & Co., of Pendleton, Salford; these oilers have easily-operated spring lids and are also supplied with an angular extension, ready for fitting to the main bearings.

The sleeved pinion on the drive shaft is fed with oil from a lubricator on top of the bearing housing, and its inner bearing on the shaft is supplied through the four oil ducts previously described. The forward bearing of the driving shaft receives oil from a separate lubricator. As the sleeve carrying the two layshaft gears needs only occasional oiling, an oil way, closed with a grub-screw, is provided for lubrication.

The gears themselves will run more quietly if given a little thin grease; Mobilgrease will serve for this purpose as it clings well to the gear teeth and is not thrown off even at moderately high speeds.

**Mounting Milling Cutters**

As previously described, the nose of the machine spindle is bored No. 2 Morse taper and threaded on the outside to correspond with the mandrel of the M.L.7 lathe. This enables cutter arbors with $\frac{1}{2}$ in. diameter parallel shanks to be accurately centred and securely held when using the standard Myford mandrel collets and nose ring. In addition, Morse taper arbors can be mounted in the tapered bore of the spindle, but it is then advisable to secure the arbor in place by means of a draw-rod of the kind illustrated in Fig. 34. For this purpose, the machine spindle is bored axially with a D-bit to $\frac{1}{4}$ in. clearing size, and the upper end of the spindle is counterbored for a short distance and then threaded $\frac{5}{16}$ in. $\times$ 26 t.p.i. or $\frac{5}{16}$ in. B.S.F. After inserting the arbor in the mandrel taper, the draw-rod is screwed into engagement, and the arbor is then secured by tightening the nut on the threaded portion of the rod. To remove the arbor, after taking out the draw-rod, a length of brass rod is pushed down the spindle bore and the arbor is ejected by tightening the $\frac{5}{16}$ in. diameter screw inserted in the upper end of the spindle. In this way all damage to the parts is avoided and a hammer is not needed.

If preferred, the ejector screw can be omitted and the brass rod is then used as a bumper to drive out the arbor.

**Mounting the Attachment on the Lathe Bed**

The scope of the attachment can be increased by mounting it directly on the lathe bed and holding the work either in a machine vice or other fitting secured to the lathe cross-slide.

With this arrangement, the set-up becomes in essential respects a small milling machine capable of dealing with a variety of light work and taking moderately heavy cuts in mild-steel.

When a $\frac{1}{2}$ in. diameter end-mill was used, cuts 15 thousandths of an inch deep were readily taken in mild-steel, and this was increased to 40 thousandths for duralumin.

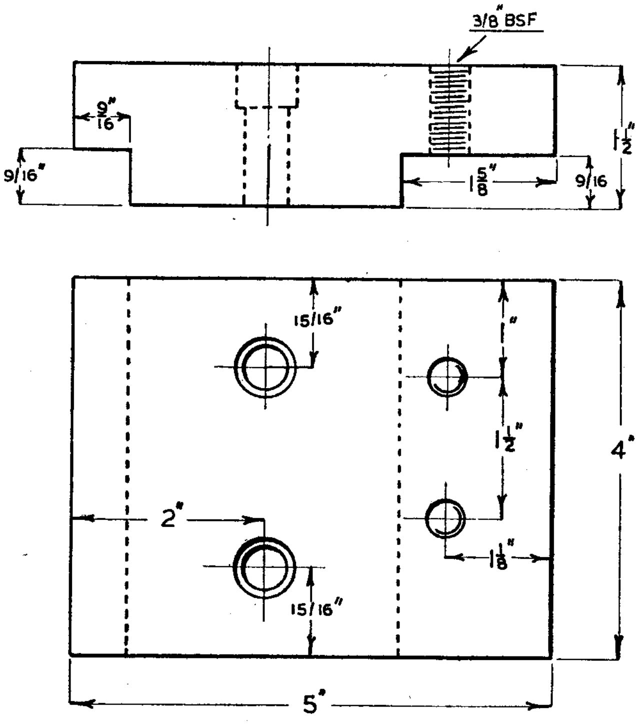



*Fig.* 36. *Details of the bed mounting plate*

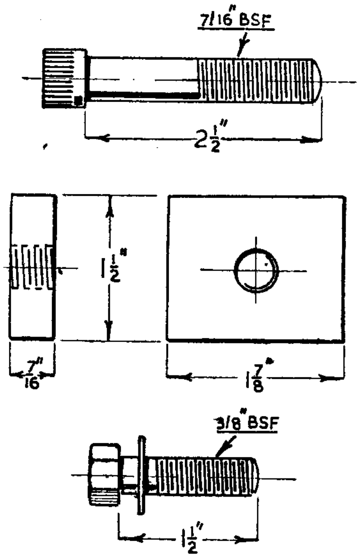



*Fig.* 37. *The bed clamps and attachment screws*

To enable the attachment to be mounted in this way, a baseplate is clamped to the lathe bed and the sides of the plate are undercut to clear the saddle wings of the M.L.7 lathe.

The baseplate illustrated in Fig. 35 was machined from the solid as a piece of mild-steel of the right size happened to be available, but the bedplate can quite well be made from two pieces of $\frac{9}{16}$ in. plate bolted together, and this will save the labour of having to undercut the material. However, an easy way out is to obtain a casting, which will only need facing in the lathe on its upper and lower surfaces. Where the baseplate is shaped from the solid, the surplus metal can be removed with the hacksaw and the surfaces finished by filing, milling, or fly-cutting.

However, much hard work can be saved by drilling two lines of holes in two planes at right-angles to one another and, when the webs between the drill holes have been cut through, most of the unwanted metal will come away. A power-driven shaping machine will, of course, do the work quickly and accurately.

The method actually adopted is illustrated in Fig. 38, and by mounting a $\frac{3}{4}$ in. diameter end-mill in a collet chuck sufficient rigidity was obtained for taking moderately heavy cuts.

The baseplate is secured to the lathe bed by means of two clamp plates abutting against the under side of the bed shears. The $\frac{3}{8}$ in. or $\frac{7}{16}$ in. diameter Allen cap-screws are put in from above and the baseplate is counterbored to allow the screw heads to lie below the surface.

If a tenon, fitting closely between the bed shears, is secured to the under side of the baseplate, the attachment can be removed and afterwards replaced without losing the original setting.

# FOR THE BOOKSHELF

**The South Eastern Railway** by R. W. Kidner. (South Godstone, Surrey: The Oakwood Press.) 52 pages, size 5 in. by 7 in. Price 10s. 6d. net.

This little book is the latest addition to a remarkable series of handbooks on railway history being gradually built up by the Oakwood Press. Mr. Kidner has written a most interesting story and has included in it some facts which, so far as we know, have not previously been published. The story is presented in a series of extended paragraphs each of which deals with a particular subject under an appropriate heading, which simplifies reference.

Three maps are printed in the text while a number of photographic reproductions, some of them unique, are printed on six art-paper inserts. Some useful footnotes are included where necessary, and a bibliography of literature referring to the S.E.R. is given on the last page. The book is an undoubtedly worthwhile production, epitomising a most interesting chapter in our railway history.

# READERS' LETTERS

**Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

### ANTIQUE FIREARMS

DEAR SIR,—With regard to "Northerner" and his query about firearms certificates for flintlock duellers.

While it is risky to "lay the law down" about the law, I can say this about his query.

A well-known firm of auctioneers (name and address furnished on request—ED., "M.E.") hold sales of antiques every quarter, and auction off hundreds of flintlocks—pistols, revolvers, and guns of all sorts and ages.

Flintlock pistols, guns and rifles, and also percussion (cap and ball) pistols, revolvers, guns and rifles, can all be bought *without* a firearms certificate. But rim-fire, pin-fire and centre-fire pistols, revolvers and rifles *cannot* be removed from the sale-room without a firearms certificate. These latter types use some form of cartridge and can presumably be converted to use modern ammunition, hence the legal precautions.

A gun licence *may* be required to carry and use a flintlock or percussion pistol, and there is no doubt the local "bobby" would be perturbed about the use of such weapons, even in sport (more so for other purposes !).

The point covering old muzzle-loaders, is that a certificate from the police is required for the purchase of powder and caps.

From personal experience I can say that to fire an old flintlock pistol is a wonderful thrill.

Yours faithfully,

Hitchin. A. GOODALL.

### CAMERA DESIGN

DEAR SIR,—I have followed with great interest the articles on camera design which have appeared from time to time in THE MODEL ENGINEER.

My first camera was a 35 mm. made six years ago, and since then I have made another, and am on with my third. In view of this I wondered if readers would be interested in some of the problems I encountered.

The first camera, incorporating a range finder, was built up partially of tin plate and black plastic for the body, and dural for the lens mount and operating knobs. The tin plate was covered with leather, and the contrast in colour between the polished dural and black Perspex seemed very impressive to me. The lens and shutter were bought complete, and as the lens focussing was done by adjustments of the front cell, constructional details were somewhat simplified. The back and bottom of the camera were in one piece, and this was made a sliding fit to the other half of the body.

One very helpful point I thought out was to make the lens mount protrude right through to the film plane. This not only made the camera far stronger, but also ensured perfect alignment of the lens to the film. The cassettes used were of standard pattern, 36 exposures on one length. The camera gave very good results, and was made for a cost of about £9.

My second one was of a similar design, but this time an adjustable lens mount was necessary, as the lens and shutter had obviously been made to be fitted into a spiral focussing mount. It is on the question of making these lens mounts that I wish to try to be of help to any intending constructor of cameras.

Cutting a square thread with three or more starts is not beyond the amateur, but it is not an easy task. I therefore designed my focussing mount to look and work like the professional 35 mm. cameras do, but with this difference—the outer adjusting ring was screwed internally with a 0.1 in. wide square thread, four threads to the inch, but the movable mount itself was not screwed. Instead a round peg was secured to it on its outer diameter, and was made just to enter the thread of the adjusting ring. Obviously this is simple and straightforward to make and on examination cannot be distinguished from the more authentic lens mounts. Another advantage is that in time, when wear takes place, the round pin can easily be removed, and a new over-size one fitted. This camera has been sold to a friend, and after three years' use still doesn't show any signs of wear. I am so satisfied with the results of the mechanism that I am incorporating the same design into my present camera.

Incidentally, I do not know whether other users of 35 mm. cameras have found this next point to be true : my experience is that, *on the whole*, 36 frames take too long to expose, and one tends to take unnecessary shots in order to fill up the film. In view of this, in my new design I am cutting down the number of frames to 18. Doing this is going to help considerably in the simplification of the interlock and winding mechanism of the film, as rewind is not necessary, and also film movement can be done by the sprockets instead of a more positive drive by a take-up winding-knob.

In conclusion, if any readers are interested in any of the points mentioned, I would willingly supply drawings and further information for publication.

Yours faithfully,

Mexborough. E. D. WINN.

### WELDING GENERATORS

DEAR SIR,—I read with interest Mr. Walton's letter in a recent issue of THE MODEL ENGINEER, and his reference to welding generators. THE MODEL ENGINEER, I believe, endeavours to furnish correct information on all technical matters submitted to them, and in this case they have done so.

Welding *in the accepted sense* cannot be carried out in a satisfactory way with the use of an ordinary generator. A welding generator is a special machine having special characteristics to suit the technique of the work, and an ordinary generator is lacking in this. As stated, a voltage of 80-100 is necessary for the purpose of striking and maintaining the arc, an ordinary generator cannot do this in a satisfactory manner. It is, of course, possible to carry out a form of welding at voltages much below the values given, but this is not true welding. If any doubt exists on this point, as to the generator being a machine specially designed for this work, any maker of welding equipment would confirm the statement given in the query reply.

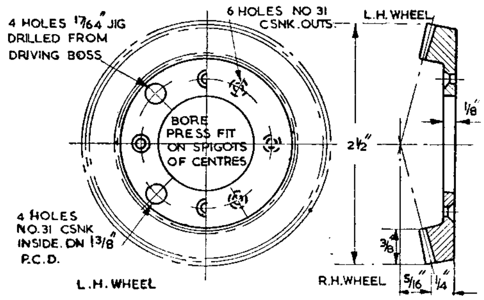
Yours faithfully,

Enfield. J. W. COOPER.

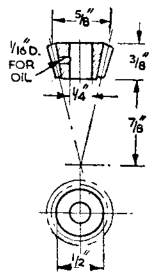
# THE ALLCHIN "M.E." TRACTION ENGINE to 1½ in. Scale

By W. J. Hughes

BEFORE starting to machine the compensating centre, we may as well turn up the centres for the two bevel wheels. You will recall that the compensating centre revolves on the bosses of these, so if we make the bosses first, they will act as plug-gauges when boring the centre. Actually, I machined the latter first, boring it out to a plug-gauge 1 in. diameter, but if you haven't one, you needn't make one if the bosses are done first. Another point, of course, is that if you happen to turn one of the bosses a shade too small, you will be able to do ditto with the second one, and then still bore the centre to match !




*Compensating-gear bevel wheels. Front elevation shows L.H. wheel at left : R.H. wheel at right. Section shows L.H. wheel at top ; R.H. wheel at bottom*




*Compensating-gear bevel pinions*

## Bevel Wheels and Pinions

First, then, here is a drawing of the bevel wheels and pinions, because these are needed before the centres are turned up. The wheels themselves are identical, but the left-hand one has *four* No. 31 holes, countersunk *inside*, and the right-hand one has *six* No. 31 holes, countersunk *outside*. The left-hand one also has four 17/64 in. holes, but these will not be drilled for some time yet.

It will be noticed that the blueprint says of the wheels " bore press fit on spigots of centres," and, of course, if you are making your own bevel wheels, you can do precisely that. But if you are obtaining them from Reeves—and he has them in stock now, by the way—they will be ready bored to 1 in. diameter, and you will have to make your spigots to fit the bores, and *not* vice versa.

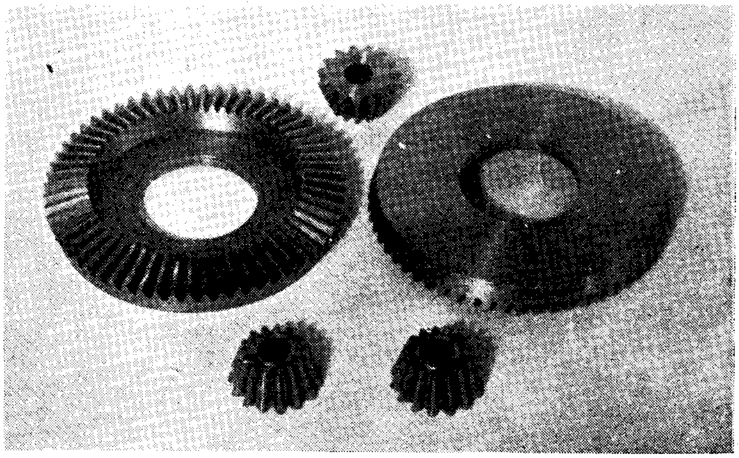
The bevel wheels are 2½ in. maximum pitch diameter with 60 teeth, which corresponds to 24 d.p. at the outer face. The bevel-pinions are ⅝ in. max. p.d., and have 15 teeth. These, too, are obtainable from Reeves, of course ; the model needs two wheels and three pinions.

An iron casting is used for the centre for the right-hand wheel. Grip it in the three-jaw chuck with the smallest boss facing outwards, and take a cleaning-up cut all over the outside.

Centre the end, and then, using successively larger drills, drill out the hole up to ½ in. diameter, which is probably the maximum capacity of your tailstock chuck. Mount a boring tool on the slide-rest, and bore out the hole to ⅝ in. diameter, when it should be a good tight fit—but not a *force* fit, on the hind axle. See you use the correct end of the axle when gauging this, of course !

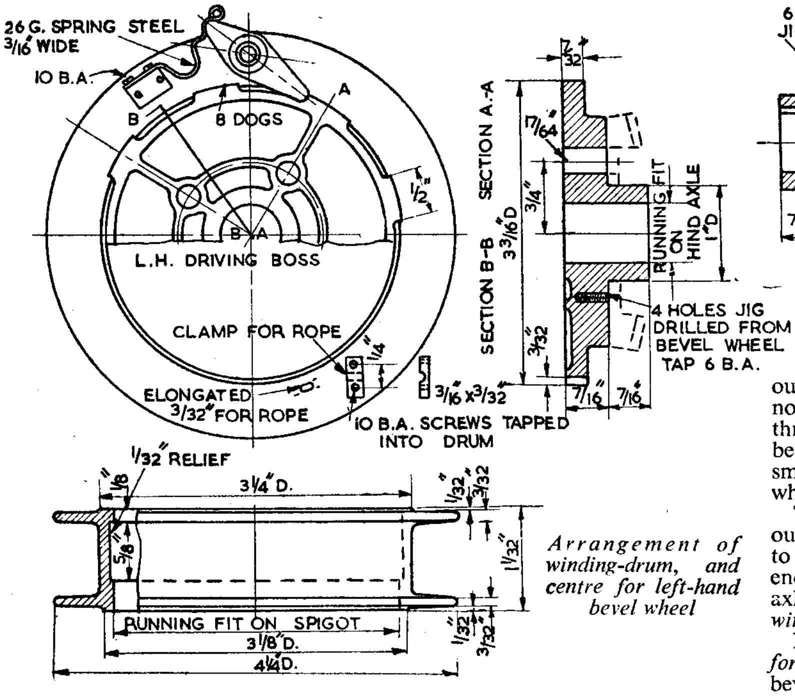
Having bored the hole to size, plane in it a keyway ⅛ in. wide, as previously described. Now turn the spigot to a length of ⅛ in., to be a *force* fit in the bore of the bevel wheel, again as previously described, and taking care that you use the correct wheel ; the bores may vary slightly in the two, you know. If they do, make this spigot to fit the *smaller* of the two bores.

This part of the machining done, mount the casting on a stub-mandrel in the chuck, or on a mandrel between centres, with the large spigot towards the tailstock, and turn the flange to thickness ⅛ in. and to a diameter of 1⅝ in. Finish the longer boss

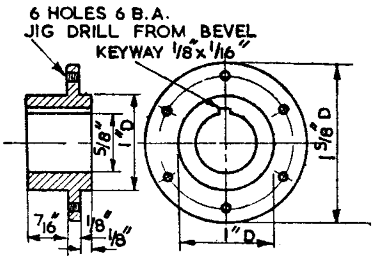


*Photograph No. 36. Bevel wheels and bevel pinions for compensating-gear*

*Continued from page 723, June 11, 1953.*




*Arrangement of winding-drum, and centre for left-hand bevel wheel*




*Centre for right-hand bevel wheel*

to $\frac{7}{16}$ in. long and 1 in. diameter. Take your time over getting this diameter exactly right, but at the same time remember that if you *do* take it a few thou. too small, all is not lost, as the hero in the melodrama said. Don't drill and tap the 6-B.A. holes yet.

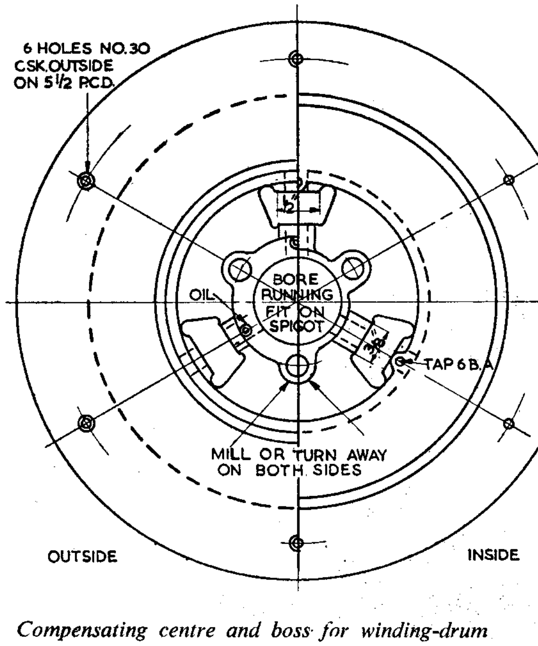
**Driving-Boss and Centre for Left-hand Bevel Wheel**

The centre for the left-hand bevel wheel is also the driving-boss for the hind-wheel and for the winding-drum, as I have said, and this too is an iron casting.

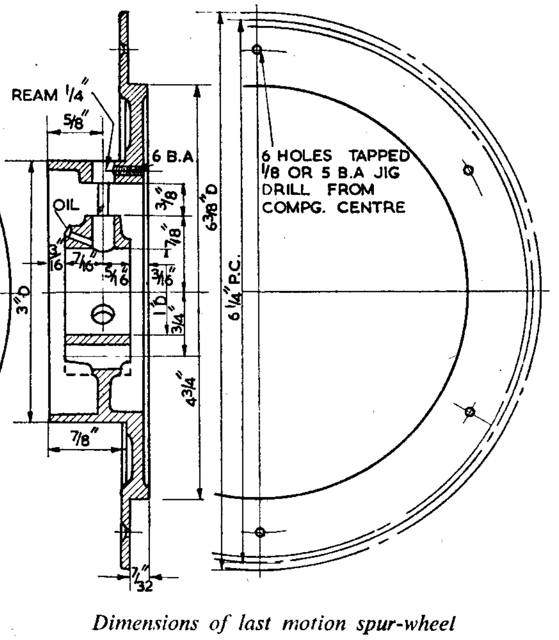
Because of the eight dogs on the outer periphery of the rim, it is not possible to grip this in the three-jaw, and so the casting should be set up in the four-jaw with the small spigot facing outwards, the whole running as truly as possible.

Take a cleaning-up cut over the outside, and then bore the hole out to be a *running* fit on the left-hand end of the hind axle. That is, the axle should revolve freely *but without shake* in the bore.

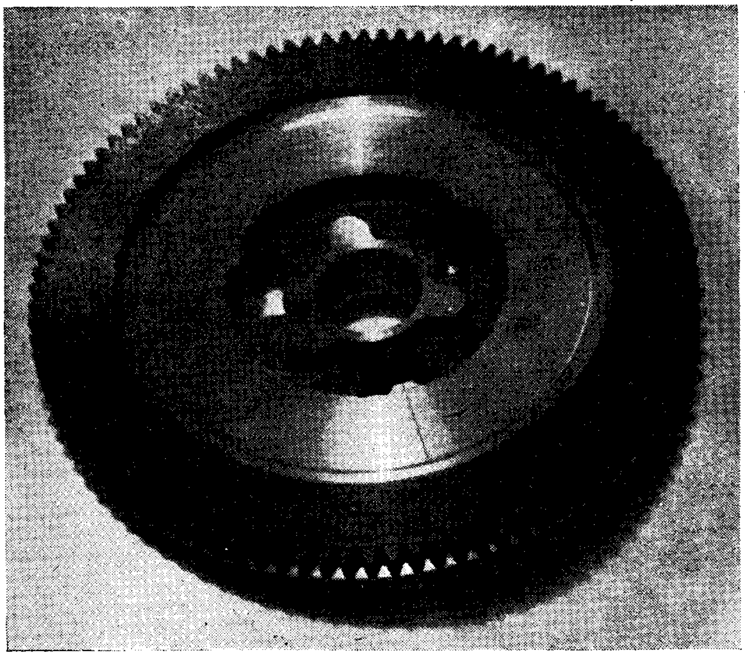
Now turn the spigot to be a *force* fit in the bore of the second bevel wheel, and check its diameter with the micrometer. It should be from one to two thous. more than 1 in., if the bore of the wheel is correct. So reduce it exactly to the diameter of the boss on the other wheel-centre, but—most important !—leave the innermost $\frac{1}{8}$ in. (where the wheel fits) to the *full* diameter. Then when you come to press the




*Compensating centre and boss for winding-drum*




*Dimensions of last motion spur-wheel*



*Photograph No. 37. Inside face of compensating centre, with spur-wheel in position*

wheel in place it will slide reasonably easily over the outer part of the spigot, but will still be a force fit on its seat. Of course, if the bore of the wheel is slightly *more* than 1 in., then you will have to take more off the boss.

And, naturally, if you turned the other boss a few thou. under the inch, by accident, this one must also be turned to the same diameter exactly. But don't be like the chap who was sawing the legs of the occasional table even with one another, who kept taking a bit off each alternately until he finished up with a footstool !

Now turn the next " step " in the centre to $2\frac{3}{8}$ in. diameter—same as the back of the bevel wheel—and 7/32 in. deep. Remove the work from the chuck, reverse it, and set it up so that the bore runs true. Then turn up the dogs to $3\frac{3}{16}$ in. diameter, and scribe a circle on the face at 3 in. diameter.

Grip the work in the vice, and carefully trim up the dogs by filing —a small rat-tail file is used for the ends, and a small smooth file to take the bottom of each gap down to the 3-in. line.

Finally, don't press the wheels on to the centres yet.

**Compensating Centre and Large Spur Wheel**

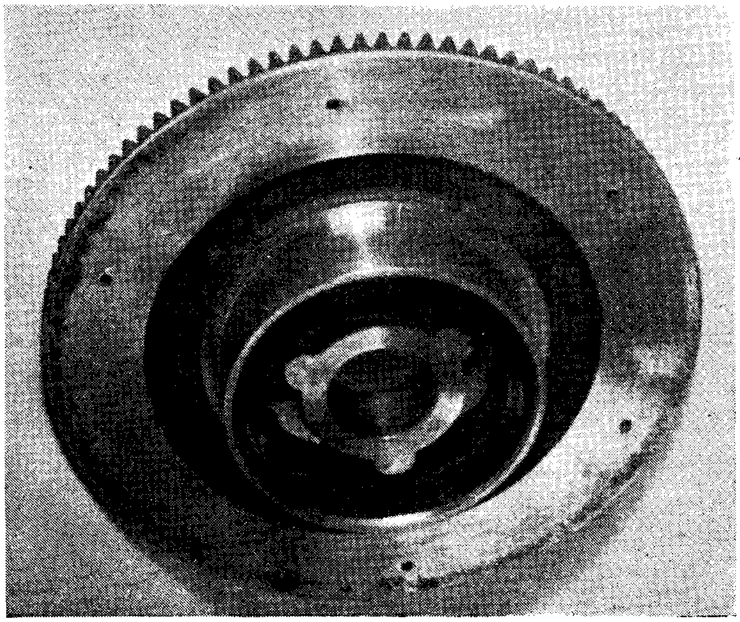
Now for the compensating centre, which is going to require some nice, accurate work. Mr. Reeves tells me that he can supply the casting either in cast-iron or gunmetal. I prefer the latter here, if only for the fact that it has to revolve on the cast-iron bosses, and the cast-iron winding drum has to revolve on the centre—acting, of course, on the old principle that it is better for dissimilar metals to rub together than similar ones.

The large spur-wheel is 16 pitch and $6\frac{1}{4}$ in. pitch diameter (100 teeth), with a width across the face of $\frac{5}{16}$ in., and is bored out to $4\frac{3}{4}$ in. diameter. As with the other gears, it is to be a force fit on a shoulder machined on the centre.

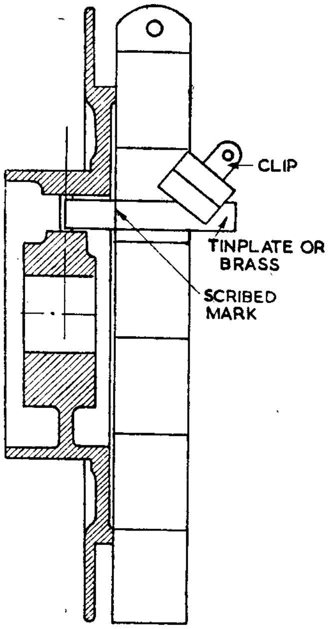
Trim up the casting for the compensating centre with files, paying particular attention to the three holes in which the bevel pinions fit, so that it will be easy later on to measure from the centre of the bosses.

Grip the casting for the centre in the outside jaws of the three-jaw chuck, holding it by the boss for the winding-drum. Set it to run true, by packing a jaw or jaws if necessary; the points to watch are the central boss and the spigot for the gear-wheel—principally the former. Tighten the jaws, but not so tight as to distort the winding-drum boss.

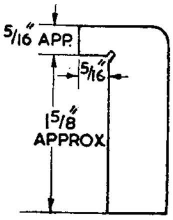
Take a cleaning-up cut over the face, spigot, flange inside the spigot, and central boss. Then place a rule across the outer face, and with a thin, narrow rule measure the distance between the face and the centre of the pinion-bosses, and between the latter and the face



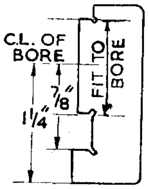
*Photograph No. 38. Outer face of compensating centre, with boss for winding-drum*



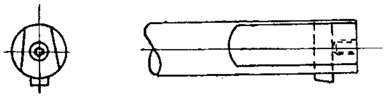

*Checking approximately how much has to be machined away*



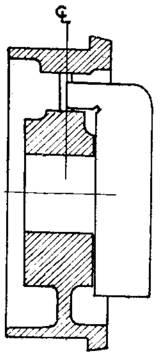

*Gauge for use in facing boss*




*Gauge for use in planing pinion bosses*



*Planing tool ground to clear pinion openings*



*Gauge in use*

of the central boss. If you haven't the said thin narrow rule, clip a narrow strip of thin brass or even tinplate to the other rule (see sketch), mark with a scriber, and then measure the scribed distances.

Now take a strip of steel or brass about 16 or 18-gauge, and make a small gauge, also as sketched. The horizontal $\frac{5}{16}$ in. measurement should be exact; the other $\frac{5}{16}$ in. and the $1\frac{5}{8}$ in. dimension need only be approximate. Mount a round-nosed tool cross-wise in the toolpost, and face back the central boss until, with the gauge across its face, the inner edge of the gauge comes to the centre-line of the pinion-bosses, as near as you can judge (see sketch).

Still using the round-nosed tool, face back the outer edge of the spur-wheel spigot until this is $\frac{3}{16}$ in. outside the face of the central boss. You can measure this by placing a straightedge across the spigot, and checking the distance from the boss to the straightedge by rule.

### Fitting the Spigot

Now use a dead keen knife-tool to turn the spigot to fit the bore of the spur-wheel, and to face up the shrouding. A *keen* tool is particularly necessary because a blunt one would overheat the shrouding, especially if gunmetal, and distort it. You have been warned !

The way I got my spigot to fit properly was to caliper very carefully the bore of the spur-wheel, and then to set outside spring calipers to the inside ones, with a 3-thou. feeler gauge added, so to speak. A delicate touch is necessary in all this, of course. The spigot was then turned down until the outside calipers just touched on the diameter; the last few cuts were only about a thou. each, so as not to "overshoot."

When the job fitted the calipers, the tool was advanced $1\frac{1}{2}$ divisions on the mike collar, and traversed about 1/32 in., when I found that the gear-wheel could just be pressed, a tight fit, on this reduced end of the spigot. So the wheel was eased off, and the spigot not touched again, because this test showed that the spigot was, in fact, now correct to force-fit the bore.

Next came the boring of the centre, with a good stiff boring tool, taking care not to get the bore bell-mouthed, and using the boss of one of the bevel-wheel centres as a plug-gauge. The boss should enter the bored hole, and be rotatable in it, but *with no play or shake.*

Now mount your dividing attachment in the end of the mandrel, with a 30-tooth change-wheel on it, and clamp it so that when the detent is in one of the teeth, or rather the hollow between two teeth, the centre of the bosses for one of the bevel-pinions, and the centre of the driving-pin boss opposite, are in a horizontal line, checked with the surface-gauge. Chalk the change-wheel at that hollow, and every fifth one round the wheel, so as to get six divisions.

Set the scriber of your surface-gauge exactly to centre height, and scribe a line right across the shrouding, edge of the spigot, cleaned up face of the inner flange, and central boss, and similarly across to the other side of the casting.

Slacken off the detent screw, and rotate the work through one division (60 deg.). Scribe another line right across, and then repeat the operation once more. Each time the scribed line should coincide with the centres of the bevel-pinion bosses, and the centres of the driving-pin bosses.

I think the best way to clean up the bosses for the bevel-pinions is to plane them off, and the photograph given in the last instalment shows my set-up for doing this. It is just the same, of course, as that described for planing the keyways, but you will find that the sides of the tool-holder require to be ground off at an angle, as sketched, in order to clear the sloping sides of the holes in the casting.

The procedure is to use the dividing attachment to lock the mandrel, with one of the pinion openings nearest to you, and to plane the face of the boss nearest to you first. Take only very light cuts, and traverse the tool *across* the face by means of the vertical slide. The depth of cut is controlled, of course, by the cross-slide handle. If you make a little gauge, as shown, it will enable you to check easily when the distance of the face from the centre is correct.

When one face is planed, slacken the detent screw, turn the chuck through 120 deg., and re-tighten the screw. Plane the surface of the second boss, and then ditto repeato with the third one.

All that remains to be done now is to reverse the planing-tool so that the bit faces the other way, and plane the inner bosses off, using the $\frac{7}{8}$ in. dimension on your little gauge to ensure accuracy.

*(To be continued)*

# MAKING A LENS ADAPTER

## By C. G. Green, A.M. Inst. Mech.

ALTHOUGH not a model engineer, I find the pages of THE MODEL ENGINEER most instructive and often very helpful in my profession as instrument maker with a well-known research group.

Most of the work I do is of an experimental nature, so I am sure it will be appreciated that model makers and I have much in common.

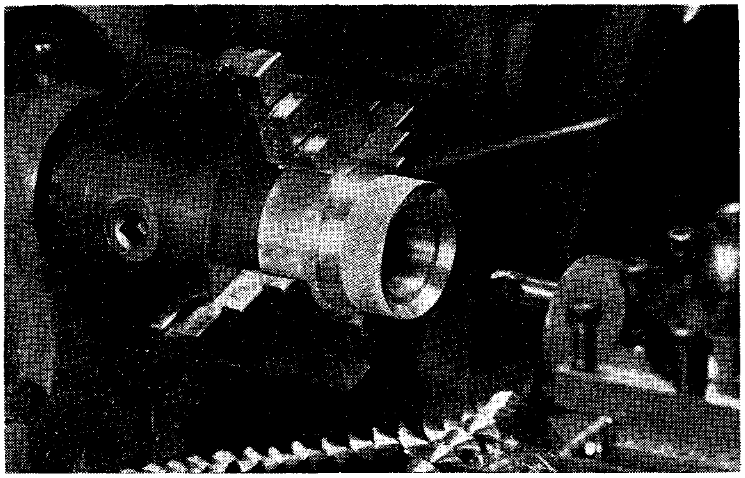
My friend and colleague, D. F. Lawson, A.I.B.P., A.R.P.S., who is the firm's photographer and who made the photographs illustrating this article, had purchased a new lens for his ¼-plate camera ; unfortunately, the threaded portion of the lens mounting differed from that on the camera, so he asked me to make an adapter. Difficulty arose in measuring the pitch of the two threads, both being fine and of short length, ending in a shoulder, thus making it very difficult to get a thread pitch gauge in position. I surmounted this trouble by making an impression of both threads in turn on a piece of modelling wax.

The adapter was machined from a solid piece of dural, 2 in. in diameter and was a fairly straightforward process. Order of operations was as follows :—

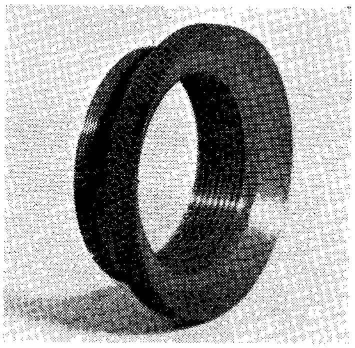
Face end, turn down outside to 1.75 in. and knurl. Bore recess and inside taper of flange. Drill and bore hole to 1.174 in. (core diameter of thread on new lens), screw 24 t.p.i.

Turn and screw stud mandrel 24 t.p.i. run on job, turn down to 1.457 in. (core diameter of thread on camera) leaving sufficient for flange, screw 48 t.p.i. and face off to correct length. The adapter was given a pleasing and durable finish by boiling for three minutes in M.B.V. solution.

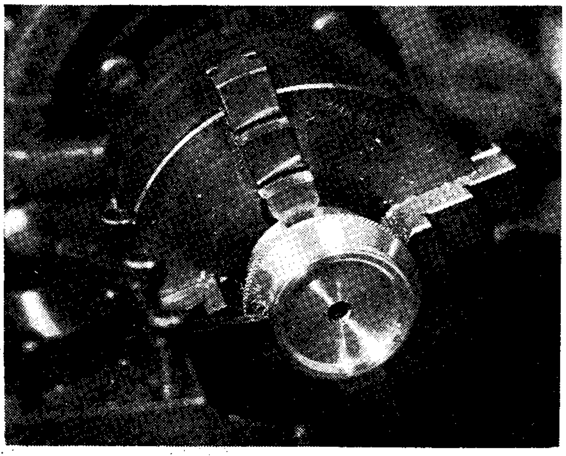
It will probably interest readers to know that my lathe is a 3½ in. Myford which has given me very faithful service over the past five years.



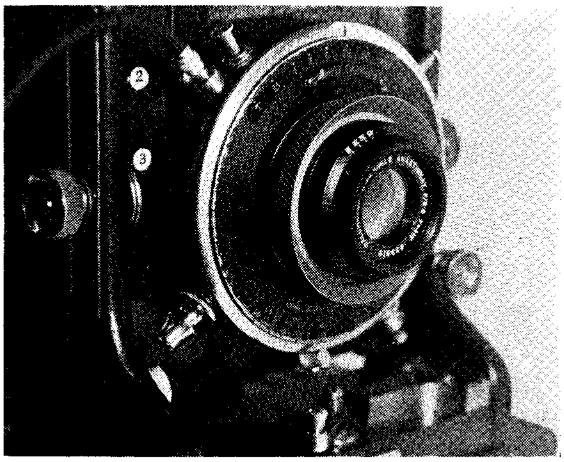
*Machining front thread*



*The finished adapter*



*Machining rear thread*



*The lens and adapter mounted on camera*

# QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

**Boiler for Boat**

*I have made a small brass cylindrical boiler for driving a boat, 24 in. long. The size of the boiler is 4 in. long × 1¾ in. diameter, and I have put in seven water-tubes of ⅛-in. copper pipe, running parallel with the bottom of the boiler. It is intended to drive a single-cylinder oscillating engine ¼ in. bore × ½ in. stroke. The fuel used is methylated spirit, and lamp is well ventilated. The boiler appears to be a very bad steamer for such a small engine. Can you tell me what is wrong?*

C.J.H. (Tralee, Eire).

We are of the opinion that the water-tubes you have fitted are too small to ensure circulation of water, and in all probability they will boil dry. We would suggest that the tubes should be at least ¼ in. outside diameter. It is also an advantage to arrange the tubes obliquely, one end coming down almost vertically and the other end entering the boiler at a fairly acute angle to encourage circulation by convection currents.

We presume the boiler is fired by a methylated spirit wick lamp. Burners of this type vary considerably in their efficiency, and it may be that this one is not supplying sufficient heat. A vaporising type of burner would be more efficient, and a blowlamp fired by petrol or paraffin would be better still. However, the wick lamp should be sufficient for driving an oscillating engine ¼ in. bore × ½ in. stroke, provided the latter is working efficiently.

**Silencers for i.c. Engines**

*Can you give me any information on the design of silencers suitable for small two-stroke engines. My engine is of 10 c.c. capacity and of the four-port type, having a port in the skirt of the piston, and two rectangular exhaust ports at right-angles, $\frac{5}{16}$ in. deep by $\frac{7}{16}$ in. wide.*

B.R.W. (Flushing, New York).

No exact information on the design of silencers is as yet available, but a good deal of experimental work is being done in this country with silencers for model speed boats. Generally speaking, it is found that the following specification gives fairly good results on all engines:

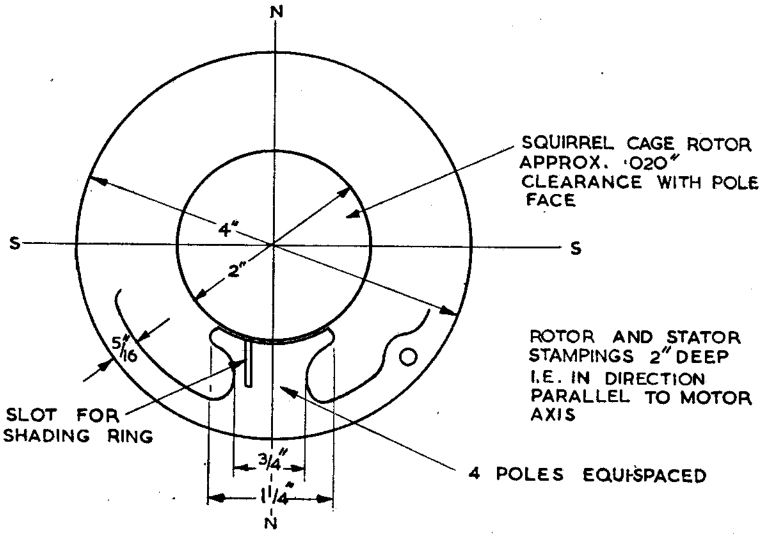
The volume of the silencer should be not less than five times the displacement capacity of the cylinder or cylinders of the engine. The outlet pipe should be located so that the gases must change their direction in passing through the silencer, and the exit pipe of the silencer should not be greater in cross sectional area than the actual exhaust port area of the cylinder. In the case of two-stroke engines, it is advisable to fit the silencer as close as possible to the engine cylinder.

The most satisfactory type of silencer construction in our experience is one made from a casting or castings, as this helps to avoid resonance, but fabricated silencers are also extensively used.

Some success has been attained on four-stroke engines with silencers of the Burgess type, in which the inner lining of the expansion chamber is perforated and surrounded by a layer of absorbent material such as steel wool or glass wool. In this case no change of direction of the exhaust passage, or internal baffles, are found necessary.

**Shaded-pole Motor Windings**

*I have recently re-wired a shaded-pole single-phase squirrel-cage induction motor, my intention being to run it on 230 volt a.c. (50 cycles) in the hope that it would produce about 1/10 h.p. Relevant dimensions are given in the sketch. The previous winding was not available, nor were there any details as to rating. I have used 300 turns/pole of 24-s.w.g. enamelled copper wire with the coils connected to give polarity, as shown. I found the motor runs well, but rapidly overheats even on no load.*




*Could you please tell me the reason for this excessive heating, and how it could be prevented? Have I, for instance, used too few turns, and if I used more, will the necessarily reduced gauge of wire safely carry the current?*

J.S. (Chigwell).

The wire size is too large and the turns too few. A winding to suit your motor may be 380-400 turns of 26-s.w.g. plain enamel-covered copper wire. All coils should be connected in series, and arranged to produce respective North and South poles.

# L.B.S.C.'s "Britannia" in 3½ in. Gauge

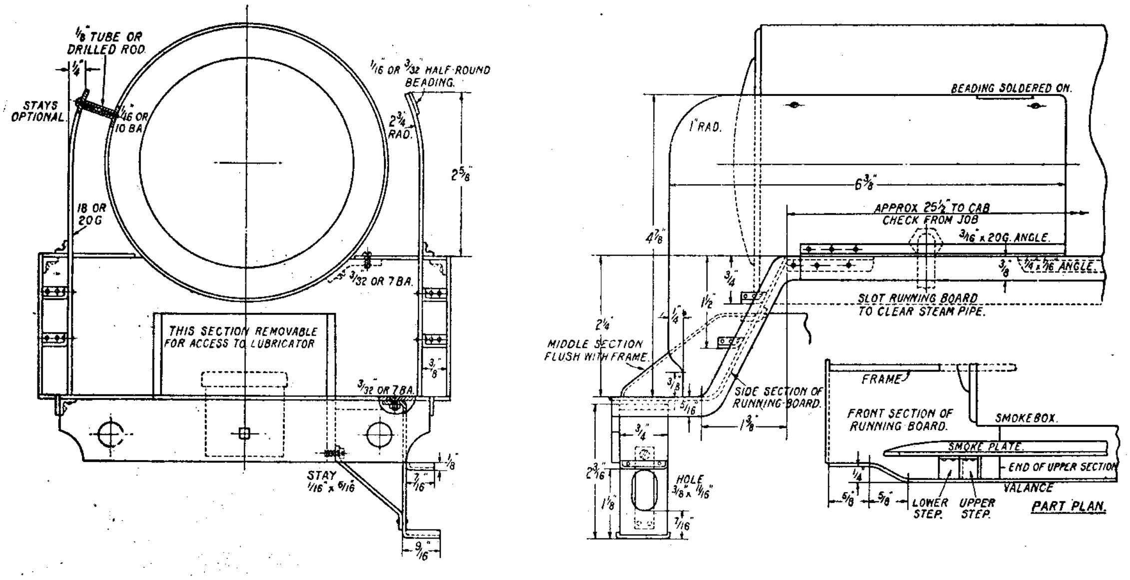
## • CONSTRUCTING THE RUNNING-BOARDS

THE arrangement of the running-boards at the front end of this locomotive will probably cause a few more words to be added to the dictionary of railroad Esperanto; many builders don't care for plate-work, and I sympathise with them, being not so keen on it myself. The running-boards taper from the firebox to the smokebox, so as to keep in contact with the boiler, and at the same time be parallel on their outer edges; they are fixed to the boiler and smokebox by brackets, instead of to the frames as is usual, thus following American practice. The side sections run as far as the smokebox, and are there joined to the front section by pieces of angle underneath. In full-size, this front section slopes back like a car windshield, and in conjunction with the smoke-lifting plates, or "blinkers" as they are called by enginemen, send up an air current, when the engine is running, that lifts smoke and exhaust steam clear of the cab windows. If any readers of these notes ever drove one of the old two-seater cars which had a sloping windshield, and a hood which came down over the top of it, leaving a gap between the top of windshield and the front edge of the hood, he will realise fully how the combination works! Many years ago, before the Kaiser's war, somebody lent me a two-seater Belsize car for a trip to Sheerness and back, one Sunday, as the train service was very poor, and my destination was a long way from the station. It started to rain on the return trip, so I put the hood up. After five minutes of a passable imitation of a Biscay gale down the back of my neck, I put the hood down again. The rain was much the preferable! If the gentle breezes blow up the front plate of *Britannia* in anything like the same proportion, I'll say that steam and smoke never have the ghost of a chance to get anywhere near the cab windows.

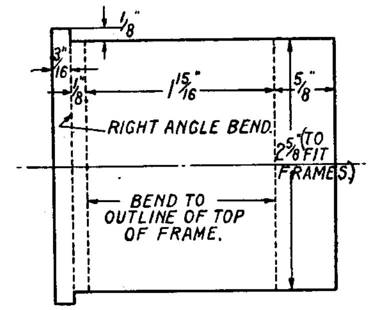
The best way to get the exact size and shape of the running-boards, is to make a cardboard template, fitting it to the taper boiler barrel; it will be about $\frac{1}{2}$ in. wide at the cab end, and gradually widen out until it is $1\frac{1}{2}$ in. wide at the smokebox. Check both sides of the engine, in case the boiler is slightly off-centre; it may be $\frac{1}{16}$ in. or so out, and this would pass unnoticed with just ordinary observation. What the eye doesn't see, the heart doesn't grieve over! When the template is O.K. use it to cut the actual running-board from 16- or 18-gauge sheet steel, either bright or blue; hard-rolled quality is best, as less brackets are needed to hold it.

The straight part of the valance that goes from the front of the cab to the smokebox, is made from 18- or 20-gauge steel strip $\frac{3}{8}$ in. wide; again, hard-rolled is best. It is attached to the outer edge of the running-board by $\frac{1}{4}$ in. $\times$ $\frac{1}{16}$ in. angle riveted on; alternatively, it could be brazed or Sifbronzed by anybody who has an oxy-acetylene blowpipe. I built up the superstructure for *Maisie* that way, and it was easier than soft-soldering. The front part of the valance can be cut to shape from sheet steel of same gauge; note that it is $\frac{1}{16}$ in. narrower.

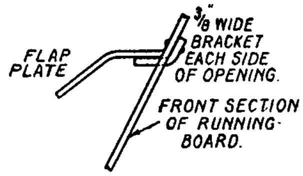
The straight section is joined to the front section by a short butt strip on the inside, riveted to the




*Arrangement of running-boards, smoke deflectors, and steps at front end*




*Removable front plate*




*Front plate support*

straight part, and attached by $\frac{1}{16}$-in. screws to the front section. Note when riveting the angles joining valance and straight length of running-board, the angles should be in two pieces, leaving a gap over the motion bracket, a little wider than the bracket itself, so as to afford plenty of clearance.

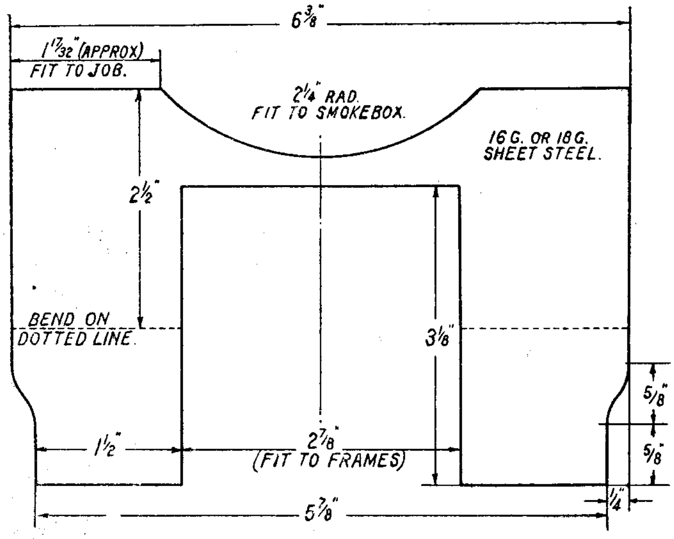
The straight part of running-board is attached to the boiler by brackets made from 3/32-in. × $\frac{3}{8}$-in. steel, bent to the angle shown, and attached to boiler by brass screws. These tiny tapped holes in the shell don't weaken it ; and if the threads are O.K. and the screws are smeared with plumbers' jointing, leakage will be *non est*. Leakage is usually the result of bad workmanship ! A slot must be cut in each running-board, to clear the steam-pipe. The best way to ensure that the running-board is level, is to stand the engine on a flat surface, set the needle of a scribing-block to the height of the running-board at cab, and then run it right along the boiler, making a good scratch. Set the brackets on the boiler a bare $\frac{1}{16}$ in. below the scratch. Fit two brackets to the smokebox, one at each end, three along the boiler barrel, at about 5 in. spacing, and one close to the cab ; the latter will have to be bent almost at right-angles, as shown in the detail sketch. The running-boards are attached to the tops of the brackets by either round-head or countersunk-head screws as desired. Leave off the front section of valance for the time being, until the front of running-board is fitted.

**Front Section of Running-board**

We shall have to make a variation at the front end, because if it were made in one piece, and the same shape as in full-size, you couldn't get at the mechanical lubricator. The sides, and the part under the front of the smokebox, are made in one piece from 18- or 20-gauge steel, as shown in the detail drawing. As the curve fits close to the bottom of the smokebox, first make a cardboard template, cutting it to the given size, and fitting it in place. Owing to the slope of the plate, the curve under the smokebox will be like a part of an oval. When the template fits O.K., cut the metal piece exactly the same, and bend as shown. No brackets will be needed for fixing this section ; just put a couple of screws through it into the top angle of the buffer-beam. At the points where it meets the sides of the "high-level" running-boards, rivet short pieces of strip steel under the latter, bend down to match the slope of the front section, fit the latter on top of the pieces of strip, and fix by a screw in each. Note : there was a slight error in outline and dimension shown at the front end of the running-board, in the illustration in June 4th issue ; but as we hadn't got as far as making that particular bit, no harm was done. The correct outline and dimensions are shown here, so all's well that ends well !

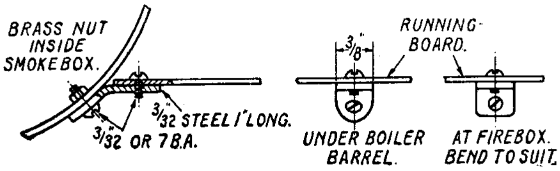
The front section of the valance can now be attached to the edges of the front section of the running-board, same as the straight part ; but note that on the sloping part, the running-board is not set level with the upper edge of the valance, but in the middle of it, as indicated by the dotted lines in the elevation drawing. It will now be seen, that by fixing the upper end of the sloping section of the valance, to the straight section, by the butt-strip, screwed as shown, the complete front section of running-board and valance is easily detachable. I always try to make it easy to take a locomotive to pieces if necessary, owing to my experiences with commercial jobs in the days when I was able to do a bit of overhaul and repair work for friends. One firm in particular, long since defunct, soldered up the whole bag of tricks, and the easiest way to dismantle one of their creations, was to apply a blowlamp flame to it. The whole lot would then promptly fall to pieces !

The gap between the frames over the mechanical lubricator, is filled in by a removable flap plate ; and owing to the presence of the oil tank, this cannot follow the contour of the full-sized front end, but must be fitted level with the top of the frame. Cut out the plate to the size and shape shown, from the same kind of metal used for the running-boards,

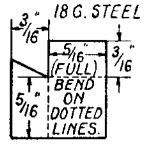



*Front section of running-boards*

and fit it carefully to the gap. The two tags at the ends, go in front of the frame plates, so that the front edge of the running-board preserves its unbroken line. The upper part of the flap plate rests on two little brackets riveted to the back of the fixed section as shown. When the vacuum-brake pipe is fitted to the front of the buffer-beam, this will prevent the flap plate slipping down. No other fixing is required.




*Running-board brackets*




*Small step "in the flat"*

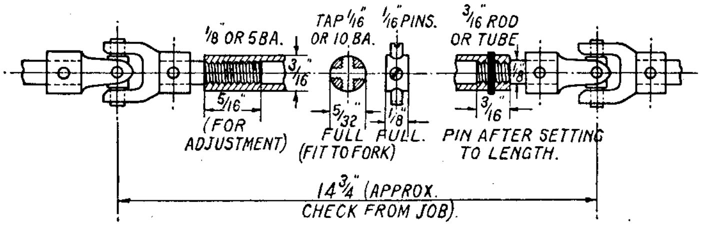
### Smoke Lifting Plates

I'll say right here, that I'm certainly *not* fitting these ugly excrescences on my own engine; I prefer "sweet beauty unadorned" as far as locomotives are concerned! However, friends and relations of Inspector Meticulous will need them, so they can be made and fitted as follows. Cut out the sheets from 18- or 20-gauge sheet steel, to shape and dimensions given; bend in the tops to the radius shown, and solder a beading of half-round wire (commercial article) all around the edges, except at bottom. If the steel is filed or scraped all around the edge, so that it is bright, solder will "take" all right on it. Silver-solder may be used (I silver-soldered all the coal rails on *Jeanie Deans's* tender) also Silbralloy or Cuprotectic.

The upper part of the lower edge (says Pat) is attached to the running-board by a piece of $\frac{3}{16}$-in. × 20-gauge angle; if not available commercially, you can easily make it by bending up a strip of 20-gauge metal in the bench vice. Rivet this to the bottom edge of the "blinker," but attach it to the running-board by round-head screws, so that if the front section of the running-board had to come off at any time, the smoke plate can come with it by merely taking out these screws.

The smoke plate is permanently attached to the front section of the running-board by the two steps at each side, which nestle in the trough between the smoke plate and valance, as shown. The steps are cut from 18- or 20-gauge steel, bent up at one side and back, and riveted to smoke plate and running-board by $\frac{1}{16}$-in. rivets, in the position shown. This job will probably provoke some more railroad Esperanto, but if so, please fire your shots at British Railways and not at your humble servant. Had it been left to me, I would have specified a much easier-fitted arrangement. There isn't any sloping front plate at all on my *Tugboat Annie*; this was because I wanted to leave the Holcroft valve-gear in full view, but if I had fitted one, it would have been different to *Britannia's*.

On the big engines, the smoke plates are stayed to the smokebox at the top; but on our little one, they are well able to stand without either moral or physical support, being the equivalent of 1 in. thick! However, the before-mentioned followers of Inspector Meticulous can stay the plates by putting a spacer of $\frac{1}{8}$-in. tube between them and the smokebox at each end near the top, and running $\frac{1}{16}$-in. screws through the plate and tube, into a tapped hole in the smokebox shell. This will enable them to sleep with a clear conscience! Don't bother about fitting the hand-rails yet, as they can be fitted at the same time as those on the boiler and cab, at one fell swoop.




*Universal joints and reversing shaft*

### Footsteps

The steps are just an easy exercise in sheet-metal working. Back part, bottom step, and top flange, are all in one piece, cut from 16-gauge sheet steel, and bent to the shape shown. The upper step can be cut from any odd bit of the same stuff, and riveted or brazed on, an oval hole being cut underneath. A $\frac{1}{16}$-in. × $\frac{5}{16}$-in. stay is riveted to the back, as shown. The top flange is secured to the underside of the running-board, either by screws nutted underneath, or by soldering a thickening piece (bit of brass strip) under the flange, and drilling and tapping screwholes through the lot. The corner of the flange will need filing off, to clear the angle at top of beam. The stay is fixed to the main frame by a screw which enters a hole tapped in frame to suit, as shown dotted in the end view.

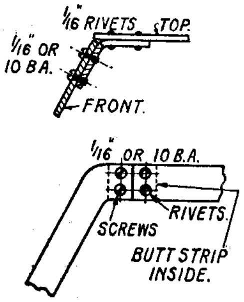
There are no steps on the engine at the cab end, as owing to its length, they wouldn't clear platforms and other obstructions, so the enginemen have to climb up to the footplate by aid of steps on the tender.

### Reversing Shaft

Most folk reckon that steam locomotives and "infernal" combustion vehicles have nothing in common: but the *Britannias* are reversed, and my gasoline-buggy is driven by an identical gadget, to wit, a tubular shaft with a universal joint at each end! The universal joints, or "Hook's joints" as old-fashioned millwrights call them, are easy enough to make. I have already described how to make the fork on the end of the reverser spindle. Make three more of them, and pin one to the end of the reversing screw on the motion bracket, at the back end. We left a bit projecting for this purpose. Fit short bits of $\frac{1}{8}$-in. silver-steel into the bosses of the other two, as shown; one is $\frac{1}{2}$ in. long, with $\frac{5}{16}$ in. of thread on it, and the other, $\frac{3}{8}$ in. long with $\frac{3}{16}$ in. of thread, either $\frac{1}{8}$ in. or 5 B.A. They are connected by a length of $\frac{3}{16}$-in. steel or hard brass tube (not soft copper) or a piece of $\frac{3}{16}$-in. rod, drilled and tapped at each end, to suit the threads on the fork spindles.

The exact length of this tube, is obtained from the actual job. First, fit the centre pieces connecting the forks of the universal joints; these are slices of bronze or steel rod, a full 5/32 in. diameter, and a full $\frac{1}{8}$ in. thick. Cross-drill them with No. 55 drill, and tap $\frac{1}{16}$ in. or 10 B.A. The holes must be at

right-angles, as shown. The pins may be made from $\frac{1}{16}$ in. silver-steel, and the ends may have small screwdriver slots, as shown; but an easier way is to screw the ends of longer bits of rod, put the centre part of the joint in place between the forks, screw the pins into it through the holes in the forks, cut off, and file nearly flush. Made this way, they can be screwed in tighter, reducing liability to come out when the engine is in service.




*Running-board and valance joints*

The connecting tube, which old motorists would call the "cardan shaft," should reach from the back boss on the universal joint attached to the reversing screw, to the front one on the reversing spindle in the cab, with about $\frac{1}{16}$ in. to spare at each end, as shown on the drawing. Note: the longer screw at one end provides for a small adjustment in length; but if any adjustment is found necessary, put a pin as shown, right through the tube and screw, after setting to correct length, otherwise the whole bag of tricks will come untwisted when the driver goes to notch up or reverse! Both ends, of course, need pinning.

A long oval hole in the running-board, and a round one in the cab front, will be needed to allow the shaft to be erected; the location of these can be easily obtained from the actual job. On the big engines, a kind of half-round "hood" is fitted over the shaft, where it passes through the running-board; on the little one, this can be bent up from a piece of thin sheet steel or brass, and soldered in position. Even with a narrow flange and $\frac{1}{16}$ in. screws or rivets, it would look clumsy.

The plumbing jobs will be dealt with in the next instalment, when I hope to give a diagram of all the pipe connections; also, describe how to make and fit the cylinder drain-cocks.

# A blind craftsman

WE have on many occasions given instances of how our readers have surmounted difficulties; many of the everyday jobs in the model workshop present a challenge to the ingenuity and resource of the worker in possession of his normal physical faculties. But much more remarkable are the cases of those who have fought, and triumphed over severe disabilities, such as would normally incapacitate them from taking part in any of the usual manual crafts. Several instances of highly skilled work by persons who have lost limbs, or have been crippled in various ways, have come within our personal experience, but a story brought to our notice recently, in the form of a cutting from a Belfast newspaper, appears to indicate that there is no limit to the ability of the human spirit to meet the challenge of physical limitations.

Tommy Topping has been totally blind since he was 18 months old; his daily occupation is one which would be considered appropriate in view of his disability, namely basket-making; but in his spare time, he indulges an inborn love of mechanical craftsmanship, by operating a home workshop, with a motorised lathe, band saw, and other tools. With the aid of a micrometer with a Braille dial attachment, which he made himself, he is able to work to fine limits of accuracy, and he can select the various sizes of drills and taps by touch alone. His first lathe was made from a sewing machine.

The workshop is largely self-supporting, as Mr. Topping makes things for his neighbours, including electric chandeliers, which he also installs and wires up. Other kinds of electrical apparatus, including radio, and all kinds of domestic appliances, come within the sphere of his activities, and he has wound a transformer for power supply to a model electric railway. We are indebted to the *Belfast Telegraph* for the reproduced photograph.